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ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

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Operations at the United Eastern Mill

BY EARLE M. BAGLEY

Complete data, including costs, on cyaniding gold ores at this plant in the Oatman district of Arizona. The writer has been in charge of the milling operations. Many interesting facts are given.

A Washington Magnesite Plant

BY GEORGE J. YOUNG

Still producing, though a "war baby." The Northwest company, which operates it, is making a dead-burned product of refractory grade. The domestic industry has had a meteoric career owing to conditions produced by the war.

What Forestry Means to the Mining Industry

BY T. D. WOODBURY

Timber is used in nearly every method of extracting ore, and the prosperity of this important business depends largely on an adequate continuous supply from the country's forests.

The Canadian Institute at Ottawa

BY GEORGE C. BATEMAN

A report of the proceedings of the annual meeting of the Dominion's mining and metallurgical engineers held last week at the capital in the Victoria Memorial Museum.

Petroleum in North Saghalien

BY HIRONAO NISHIHARA

Signing of the new Russo-Japanese basic treaty on January 20 has brought into prominence once more the question of the oil resources of this island. A brief sketch of the nature and extent of the petroleum occurrences thus far noted is given.

Recovering Stuck Diamond Drill Bits

BY ROY H. POSTON

A number of causes may prevent the withdrawal of the expensive cutting tool, as every experienced operator is aware. Methods and equipment for overcoming such difficulties are described in the Useful Operating Ideas section.

Treating Mine Timber Pays

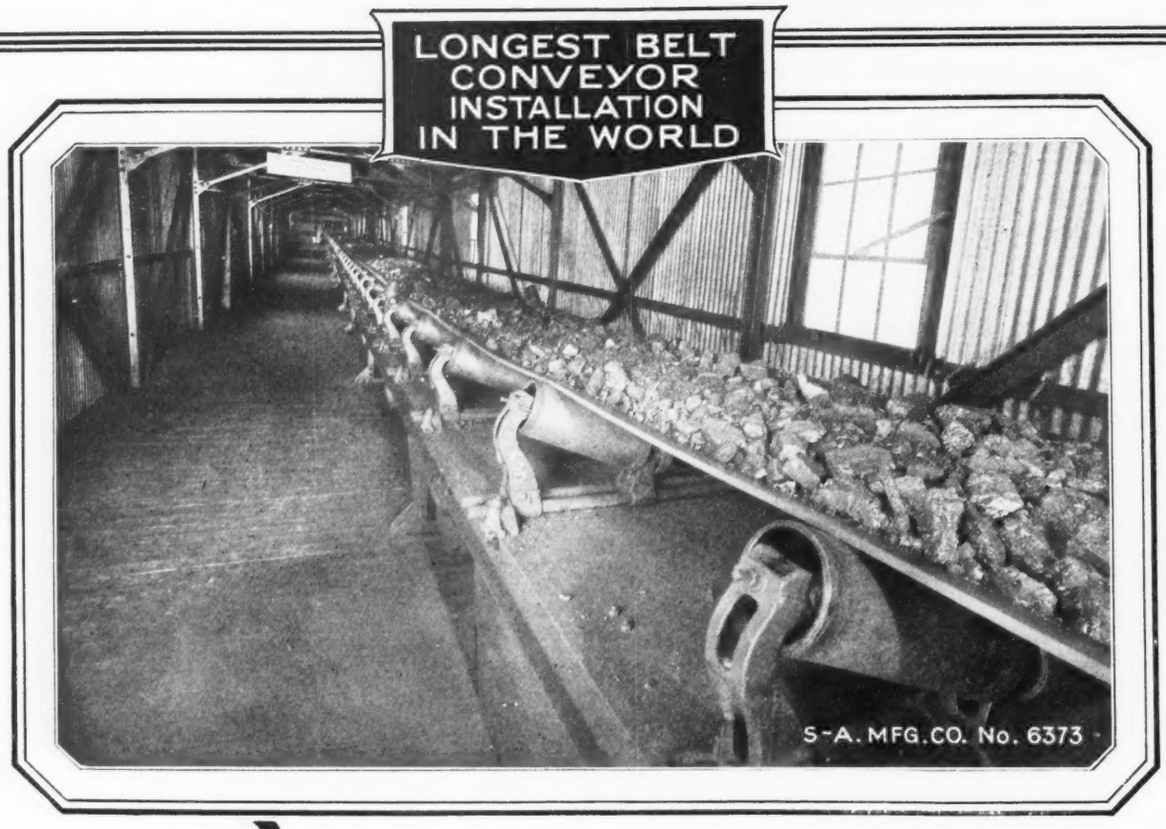
BY HARRY E. TUFFT

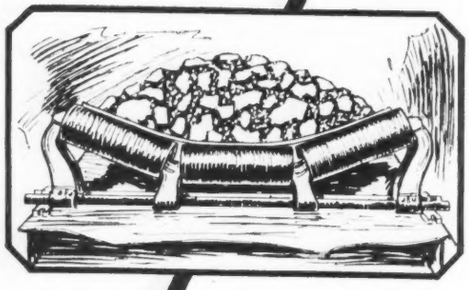
Operators can reduce costs by using a suitable preservative where replacement from decay is expected. The probable savings from such procedure at a certain mine have been estimated in this short article in order to prove this statement.

Also

Monthly Review of the Situation at the Mines
New Machinery
Freight Rates

Miles and Miles by S-A





MILES and miles of S-A Belt Conveyors are carrying run-of-mine coal from the mines to the tipple. Consider an installation of 48-inch wide belt conveyors carrying over 1,200 tons of coal per hour for a distance of over four miles—a real he-size job, you will admit!

An installation of this large capacity and distance range assures every operator that an S-A Conveyor is the right equipment for the job, whether large or small. While conveying for such distances has not previously been accomplished in this manner, the successful functioning of this particular equipment establishes without question the ability of the belt conveyor as a means of long distance transportation for bulk materials.

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

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Mine Financing

WHILE many studies in mining have been contributed to literature and are available as guides, there are many departments of the industry where the best procedure still needs to be formulated, and the principles need to be reduced to written language. The principles of marketing have been recorded through the efforts of *Mining Journal-Press*. This refers to the marketing of mine products. But the science of marketing mines is another thing.

The whole problem in mine finance is obscure and chaotic and demands further interpretation. Pioneers in mining development are anxiously seeking the right and at the same time the profitable way to finance mines. There is one fundamental fact: capital is necessary. How shall capital be raised for the promising prospect, by selling it or leasing it to mining capitalists, or by independent financing? For the former method there is a wide opportunity: capitalists are hungry for good mining investments and have enormous difficulty in finding them, but their vision is necessarily limited; there are many angles which they cannot see: so that the owner of a promising small mine or prospect may not secure the approval of the engineers of the big mining company, or may not be willing to accept the terms that the company feels it must have in order to make the enterprise warrantable. A small syndicate of friends or neighbors or local merchants often solves the problem.

In the end, however, we cannot deny that it is from the public that capital must come. So rich in the aggregate is the American public—so widely has moderate wealth been distributed—that not only small but large business undertakings have come to be absolutely dependent upon wide public participation. Whether it is a loan to France, or feeding the Armenians, or financing the Jack Daw mine—the money must mainly be drawn from the pockets of the investing public.

The rules of the game come then in the proponents of an enterprise not misleading the public—in playing fair. The public does not—perhaps unfortunately for itself—demand a sure thing. Bond houses which have put forth a bond issue in good faith, but have found themselves mistaken in their judgment through the bond "going sour" and depreciating in market value, still hold up their heads and continue doing business to the best of their ability. The head of a great New York bank who was also head of a great commercial enterprise which went bankrupt through the effects of the war, with a total loss to stockholders, still continues guiding the affairs of the bank. The best and most successful of men has a number of mistakes mixed with his successes; and if he is a speculative financier, some of his enterprises will have "gone sour," carrying his clientele along with them. We need only mention Yukon Gold, Alaska Gold, United Comstock, as types of many others. Therefore there is certainly no inherent reason why the small miner and promoter should not seek public participation. The only condition is that he shall have common sense and conservatism and be honest in his statements to the public. If it is a speculation, tell them so, and invite them to participate if they wish. The two cardinal sins in mine financing are, first, ignorance, and, second—the will to deceive the public.

Therefore the test of a dishonest mine promotion, whether big or little, is in the literature: whether it is intelligent and honest, or whether it is saturated with buncombe. In the former case, almost any mine can be promoted honorably. In the latter, no mine promotion is an honest one.

Fire as a Mineral-grinding Agent

FIRE is one of the most ancient agents for breaking rock. Ages ago man learned that building a fire on a rock surface, thus heating the rock to a depth of several inches, would cause a splitting or shattering, particularly if water were thrown on the hot surface. In British India the method was employed even in recent years in splitting off thin splinters of granite to be used for telegraph poles. Such primitive methods sometimes exhibit a remarkable persistency and appear as phases of modern practice. In some European mines "fire-setting" was prevalent until the nineteenth century.

Probably the last remnant of the heating of rock to bring about its disintegration as a mining or milling process is to be found in the calcining of flint preliminary to grinding for ceramic use. Examination of the calcined pebbles reveals very numerous minute fractures. Quartz at a temperature of 575 deg. C. reverts from α to β form, a crystallographic alteration with accompanying change in volume of over 2 per cent. It is probably at this temperature that most of the fracturing occurs. Thus the ancients profited by a property of the mineral which they did not in the least understand.

The process employed by some of the Trenton, N. J., manufacturers of pottery materials is a calcination of the flint in bottle-shaped kilns, using about one cord of wood for fifteen tons of flint. The calcined material is then crushed with stone chaser mills and ground in tube mills.

A paper presented at the recent meeting of the American Ceramic Society at Columbus, Ohio, describes a series of tests conducted at the New Brunswick, N. J., Experiment Station of the U. S. Bureau of Mines to determine the actual advantage of such a process. Samples of commercially calcined flint, also flint calcined in an electric furnace, part of which was cooled in air, and part quenched in cold water, were ground in porcelain pebble mills under exactly the same conditions as uncalcined flint, and screen tests were made of the resulting products. Briefly the results indicated a decided increase in fineness where calcination was followed. A product 70.1 per cent through a 325-mesh

screen resulted from grinding uncalcined flint, while calcined flint similarly ground gave a product 92.8 per cent of which passed the same screen.

Though grinding is thus facilitated by calcining, it is concluded that the advantage is probably insufficient to justify the extra expense of calcination, particularly if more modern crushing machinery were used. The adherence to the method is probably due in some measure to the use of chaser mills for preliminary crushing. Aside from the general inefficiency of chaser mills, the smooth rounded flints would undoubtedly fly out from beneath the stone edge runners in much greater numbers and with greater force than would the heat-fractured flints. Other types of crushing equipment such as manganese-steel jaw crushers are now being employed in many mills, and accompanying the introduction of such improved machines the passing of the calcination process may be expected. Thus one primitive method goes hand in hand with another, but the old is ultimately replaced by the new.

The Mining School Problem

TO THE INQUIRY which comes to us repeatedly "What is the best mining school in the country" we are in the habit of returning a vague and evasive reply. The reason is only partly the reluctance to sit in judgment upon a highly debatable matter; it is also due to the fact that the real situation is obscure. And yet it would appear that conditions in the mining industries of the United States and elsewhere favor the development of one mining school which should be confessedly the best. Instead, wherever we look, we see change, unrest, and uncertainty in the different centers of mining education; an impulse to change, based of course upon the desire to improve and to grow; but an impulse which does not seem to result in what was hoped. The time was when Freiberg, in Germany, was the best mining school in the world; it is doubtful if any mining school since has attained a similar general regard. That, of course, is long past. The Royal School of Mines, in London, and the School of Mines at Columbia enjoyed for a while somewhat distinctive positions. They have not been maintained. Columbia, for example, still maintains its splendid mining faculty, but the attendance has fallen off; and in the meantime other institutions have developed notably capable faculties, such as the Massachusetts Institute of Technology, Lehigh, Toronto, and others which will come readily to mind.

The Mid-Western mining schools hold the bulk of the students, such institutions as the schools of mines of Michigan, Colorado, Missouri, Idaho, and Arizona. They have certain definite advantages of location, which helps the demonstration of practice and technology; Freiberg, it will be recalled, had similar advantages; which may help in discussing what will eventually be the great mining school, which all mining schools are striving to be. The state schools which we have named have the drawback of not yielding to students that general culture which, in the long run, is as essential to the success and happiness of a mining engineer as of anyone else. Such advantages are given by the Eastern schools, connected with the great liberal universities, such as Harvard, Yale, and Columbia. The present indications, judging from attendance, are that the student does not value this advantage highly enough; but it is what stands in the way of the state mining schools in their laudable desire to improve and take unquestioned first rank.

If it is on the cards for any mining school to become unquestionably stabilized and pre-eminent, our judgment is that it will be a school in a small town or city, close to firmly entrenched and stabilized mining industries and not too far from the industrial centers. Such a school must be endowed, and not be dependent on annual state appropriations by agrarian legislatures. It will teach practical mining, with the scientific preparation; and it will keep in mind the cultural side and the problems of human intercontact. It will also consider mining as a business, as well as an art. It will have a faculty not of rule-of-thumb teachers but of men who will awaken thought and yield inspiration. It will not turn out roughneck graduates; neither will it turn out graduates who are ignorant of real mines and mining, and of the social problems, of the hardships and joys, of the life. It would be difficult to name such a school; but when it arises it will become famous.

Meantime, from all these diverse centers of mining engineering, with such different environment and training, we are turning out a lot of wonderfully fine engineers, splendid fellows and efficient doers. All this speaks volumes for the high character of the average mining-school faculty.

There is an old sage bit of advice, for the Eastern man to go West to college, the Western man to come East. This may perhaps apply to men who wish to become mining engineers, as well as any other general advice. If you have been raised in the mining regions of the West, come East to the great university centers for your mining education. If you have grown up in the East, or in regions where mining is not familiar, go to those schools in the West and Middle West which are close to the heart of the business.

Effect of the Carson Patent Decision

THE DECISION of the Ninth Circuit Appellate Court upholding the Carson patents on side-feeding reverberatory furnaces indicates the probability that royalties may be exacted from the present users of this type of furnace as well as damages of uncertain amount for past use. It is not at all likely that users of the reverberatory will go back to the old uneconomic method of feeding all of the material at the back of the furnace and protecting the sidewalls with siliceous fettling, introduced through doors in the side; though this could be done if the royalty demanded should prove excessive. It is also unlikely that most metallurgists would seriously consider, as has been suggested, the sintering of flotation concentrates, with subsequent blast-furnace smelting.

However, the imposition of this royalty will no doubt prove stimulating to metallurgists. It may make them think, for example, of treating the concentrates by hydrometallurgical methods. Sulphate roasting and the dissolving of the copper and associated metals under varying conditions of temperature, pressure, and solvent has been proposed in years gone by, and considerable experimental work has been done. A copper-bearing solution is thereby obtained from which the metal may be electrolytically deposited. There are many attractive features in this proposed method of treatment, but it has not been seriously tried out, on account of the convenience and established character of existing smelting methods.

One of the Small Mine Owner's Problems

WE HAVE RECEIVED a letter from an old prospector in the Northwest who has taken a lease on a property which failed to yield a profit to its former operators; in fact, after they had spent more than $25,000 on a concentrating plant, he reports that the project was a complete failure and that the machinery was sold in part to pay the debt incurred. The prospector thought that possibly modern methods might make the mine, which contains complex ore, a paying venture, and has apparently spent considerable money in having assays made and in sending samples of his ore to companies exploiting various processes. The assays, he reports, show a wide variation, from $1.25 in gold in a sample of the ore to $52 in gold and $793.50 in platinum, in a sample of 6 to 1 concentrates. His latest hope is in an exploration and development company in Denver, to which he has sent samples for a test by its process, which consists in "getting returns by reducing the metals to fumes in an air-tight furnace."

We fear that our friend is wasting a good deal of good money on disreputable assayers, and that he is likely to have false hopes aroused by the backers of some half-baked process which will get more out of an ore than there is in it. A man in his position can do no better, we believe, than to state his case frankly to his state bureau of mines and to rely on the bureau's advice, rather than to deal with assayers and process mongers about which he knows nothing. And we also believe that this is a very real and necessary field of activity for such state bureaus—to help the man who cannot afford the services of the right kind of consulting engineer.

Doodlebugus var. Petroliensis

THERE WILL BE always those among us who believe in magic, in good and bad omens, in table-tipping spirits, in get-rich-quick stocks. And we will back our belief up with our money. The doodlebug is just such a deathless apparition—we shall always have it with us. The vision of it comforts the widow and the elderly clergyman, and the man who sees no avenue of escape from his rut except through a speculative "killing" in the stock market.

A correspondent sends us a circular exploiting an old variety of the doodlebug—the Doodlebugus petroliensis. He has appeared at intervals of a few months for many years. It is safe to say that he is immortal. He does not change in form or in song. Intelligent business men listen to him gladly: men who were supposed to be bereft of imagination see visions when he articulates.

The circular is from the Coursen-Matches company, oil operators, Kansas City, Mo. It appears they have some oil lands which we will not name, but which sound strangely familiar to us through previous promotion literature. Be that as it may, this circular is a devout hymn of glorification and trust in a doodlebug instrument "perfected by Mr. George W. Perry." The instrument was first tested privately:

> "Mr. Perry then set up his 'mineral indicator' in our room and made some local tests with various mineral ores and other substances, to show us its method of operation, which demonstration was most impressive, to say the least, and could leave no doubt in anyone's mind as to its accuracy in this instance."

Then Mr. Perry's instrument was taken out over the oil fields, and, needless to say, found oil in great abundance at once. Mr. Perry's chief difficulty was in finding a limit to the oil—the "edge of the oil vein," as he quaintly put it. There was, in short, no edge. There is no more to be said.

> "Here we have a combination of Science and Geology, one absolutely checking the other:—'the World's Most Famous Geologists have already said that here, in their estimation, was the greatest undeveloped Oil Field on the American Continent. Mr. Perry's report speaks for itself."

Therefore, all ye people, buy stock in this promotion, at $30 a share.

"Subscriptions for Pool Interests will be filled in the order in which they are received. We would suggest wiring your reservations, at our expense," says Mr. Matches. All good doodlebug worshippers will make obeisance and pay the usual tribute.

What was it that Barnum said?

Riparian Rights and Water Storage in California

A RECENT INJUNCTION given by Judge J. E. Woolley of the Fresno County Superior Court of California is of interest to hydraulic and placer miners. By the terms of the injunction the Southern California Edison Co. is restrained from further impounding water on the headwaters of the San Joaquin River in conjunction with its Big Creek-San Joaquin hydro-electric development.

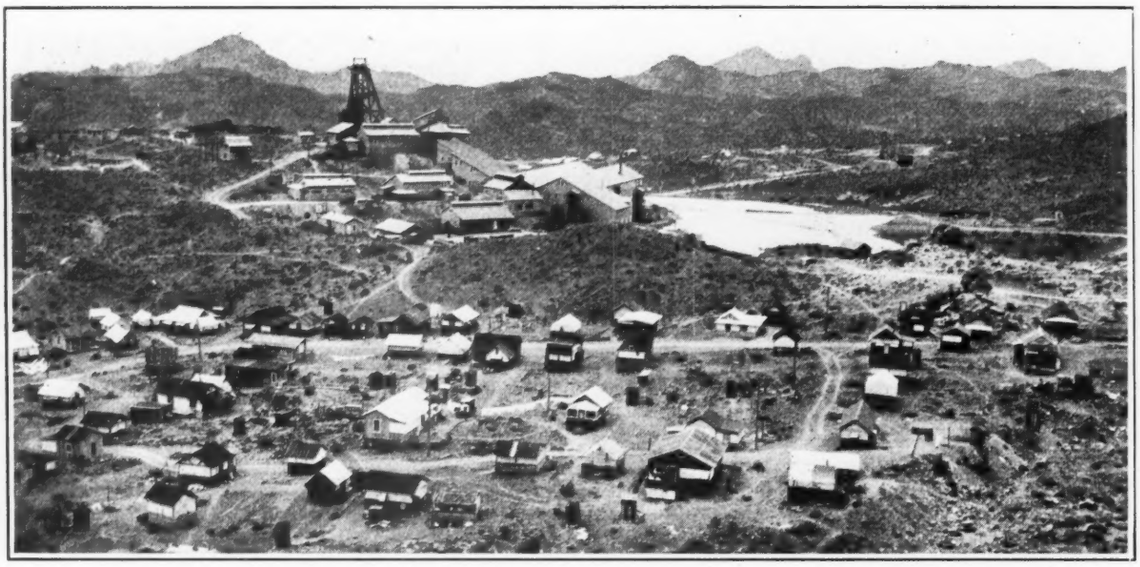
Under the terms of the decision water may be diverted into Huntington Lake and thence run through the chain of power houses on Big Creek and the San Joaquin River, but no storage will be allowed other than that coming from the run-off in the Huntington Lake basin.

The suit brought by the Herminghaus heirs was filed on the grounds that the storage of the flood waters of the San Joaquin River in reservoirs for the generation of power prevents the normal spring floods from inundating the lands of the estate and thereby depositing silt and replenishing the ground-water supply, thus damaging the property and interfering with the riparian rights.

The Edison company raised the point that as lessees of the government it was entitled to the riparian rights of the government as owners of the public domain. The court agreed with this contention, but held that storage of flood waters for power generation was not an incident of riparian ownership. Such use was unreasonable, in the opinion of the court.

J. F. Truesdell, attorney for the government, under examination by the court, during the course of the trial stated that in his opinion the government has the power as riparian owner of the public domain to store waters from a wet to a dry season. Irrigationists of the San Joaquin Valley were generally in sympathy with the Edison company, holding that storage of the spring run-off is both beneficial and necessary. It was their opinion that appropriation of flood waters for storage in high reservoirs should be permitted, because such waters have no present or future beneficial use to riparian owners.

Similar decisions might interfere seriously with the plans of hydraulic and placer miners who must depend upon water storage for their operations. If any development is to take place in hydraulic mining, co-operation between the miners, irrigationists, and public-utility power companies is essential to secure adequate water storage for all purposes.



General view of United Eastern headframe and mill, with camp in foreground

Operations at the United Eastern Mill

Complete Data, Including Costs, on Cyaniding Gold Ores at This Well-known Plant in Arizona

By Earle M. Bagley
Mill Superintendent, United Eastern Mining Co.

THE UNITED EASTERN MINING CO.'S mill is situated at Oatman, Ariz., 28 miles by automobile road from Kingman, the nearest railway connection. The ores from the United Eastern and Big Jim mines were treated at this plant. The last ore from the United Eastern was milled in July, 1923, and the last from the Big Jim in May, 1924.

The ores from the two mines were much alike, and but little change was necessary in the details of operation when the mill feed was changed from United Eastern to Big Jim ore. Both ores consisted of a mixture of quartz and calcite, with some andesite, and were readily amenable to cyanide treatment. The values consisted of gold and silver in a very finely divided state. This characteristic made it necessary to slime the entire mill feed. The silver-gold ratio was about 1 to 2 by weight.

At the United Eastern mine the ore was hoisted in 2½-ton skips which dumped automatically into a 250-ton flat-bottomed ore bin. This bin delivered about 180 tons by gravity. The Big Jim ore was transported a distance of one mile to the mill by a Riblet aërial tramway and dumped into a bin adjoining the one described above and having the same capacity.

The ore was broken underground to pass through grizzlies with bars spaced at 10 in. At the coarse-ore bins the ore was dumped from the skips and tram buckets upon inclined grizzlies with bars spaced at 2 in. The fines fell directly into compartments, from which they were drawn by means of an 18-in. horizontal belt conveyor and fed to the inclined conveyor leading to the fine-ore bin. The coarse ore was drawn from the bins by a 42-in., maple-lined, Link-Belt pan conveyor, and fed to the coarse crusher, a No. 6 Telsmith. This crusher delivered 35 tons per hour, making a 2-in. product. The crushed ore was joined by the fines passing the grizzlies, and was transported on an 18-in. belt conveyor having an inclination of 20 deg. This conveyor operated at a speed of 250 ft. per minute and delivered 50 tons per hour to the fine-ore bin. The ore was weighed automatically by a Merrick weightometer.

Table I—Costs of Coarse Crushing per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.030	$0.017	$0.011	$0.001	$0.059
1918	0.035	0.032	0.010	0.005	0.082
1919	0.027	0.014	0.009	.....	0.050
1920	0.031	0.010	0.011	0.002	0.054
1921	0.028	0.019	0.012	.....	0.059
1922	0.022	0.011	0.010	.....	0.043
1923	0.027	0.011	0.009	.....	0.047
1924	0.030	0.014	0.009	.....	0.053
Average....	$0.028	$0.016	$0.010	$0.001	$0.055

The fine-ore bin consisted of a 24x24-ft. flat-bottom wood tank of merchantable Oregon pine, with 4-in. staves. The ore was drawn from this bin through a bottom opening, the size of which was regulated by means of a rack-and-pinion gate. An 18-in. Link-Belt pan conveyor fed the ore to two No. 64½ Marcy ball mills. These mills ran at 26 r.p.m., and each mill required on the average 67 kw. Each Marcy mill was in closed circuit with a special simplex Dorr classifier having a slope of 3 in. per foot and making thirty-four strokes per minute. The ball mills had a capacity of about ten tons each per hour. One Marcy was run continuously, and the other as long each day as the requirements of the cyanide plant demanded. The ore fed to the coarse-grinding mills was crushed to pass 2 in.

The pulp overflowing the simplex classifiers ran by gravity to a pulp distributor, which distributed the feed evenly to the regrinding mills. The fine grinding was done in 5x6 ft. Allis-Chalmers ball granulators. Each mill operated at 28 r.p.m. and consumed 48 kw. on average load. Each mill was in closed circuit with a 54-in.

Model C, duplex Dorr classifier, having a slope of 2¼ in. per foot and making eighteen strokes per minute.

Table II—Typical Screen Analyses in Coarse Grinding

Mesh	Marcy Discharge	Classifier "Dragover"	Classifier Overflow
Plus 4	1.0	2.5	....
Plus 6	2.5	9.5	....
Plus 8	7.5	19.0	....
Plus 10	16.0	35.0	....
Plus 14	28.0	54.0	....
Plus 20	37.0	67.0	4.0
Plus 30	54.0	81.0	19.0
Plus 48	61.0	85.0	28.0
Plus 65	66.0	88.0	37.0
Plus 100	70.0	89.5	44.0
Plus 150	73.0	91.0	48.0
Plus 200	77.0	93.0	66.0
Minus 200	23.0	7.0	34.0

The pulp overflowing the duplex classifiers was maintained at a consistence of aout 5 to 1—solution to solids. It ran by gravity to two 8-ft. Callow cones. The spigot product was returned to the classifiers by means of two No. 3 Abbe-Frenier sand pumps, and the overflow went to the cyanide department.

Table III—Costs of Coarse Grinding per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.057	$0.110	$0.118	.....	$0.285
1918	0.055	0.142	0.147	0.002	0.346
1919	0.055	0.157	0.163	.....	0.375
1920	0.056	0.121	0.186	0.022	0.385
1921	0.048	0.106	0.185	.....	0.339
1922	0.045	0.148	0.171	.....	0.364
1923	0.051	0.149	0.160	.....	0.360
1924	0.056	0.175	0.193	.....	0.424
Average	$0.053	$0.136	$0.164	$0.003	$0.356

Table IV—Marcy Mill Liner Consumption and Cost

1917 to 1918	Feed End, Manganese Steel	Shell, Manganese Steel	Grates, Chrome Steel	Total Cost per Ton
Pounds per ton milled	0.072	0.163	0.055	.....
Scrap, per cent	32.2	45.5	48.4	.....
Cost per ton milled	$0.0110	$0.0268	$0.0137	$0.0515
1919 to 1920				
Pounds per ton milled	0.051	0.198	0.045	.....
Scrap, per cent	33.3	39.6	49.0	.....
Cost per ton milled	$0.0114	$0.0275	$0.0108	$0.0497
1921 to 1924				
Pounds per ton milled	0.059	0.220	0.043	.....
Scrap, per cent	34.0	42.5	50.0	.....
Cost per ton milled	$0.0099	$0.0336	$0.0099	$0.0534

The ore from the United Eastern mine was ground so that 85 per cent passed a 200-mesh screen. Finer grinding was necessary, however, with much of the ore from the Big Jim. About 92 per cent had to be ground to pass 200 mesh to obtain satisfactory results.

Table V—Typical Screen Analysis in Fine Grinding

	Ball Mill Discharge	Classifier "Dragover"	Classifier Overflow	Cone Overflow
Plus 48	4.07	5.43	.....	.....
Plus 65	11.12	13.71	.....	.....
Plus 100	24.18	30.00	.....	.....
Plus 150	43.75	57.30	5.01	0.12
Plus 200	63.75	81.40	23.55	7.08
Minus 200	36.25	18.60	76.45	92.92

Shell linings made of 35-lb. T-rails were used in two of the regrinding mills since early in 1922. The rails were held in place by two bolts between each pair of adjacent rails, the bolt heads engaging the rail bases and the bolts passing through the shell. The rails proved more economical than the chrome steel lining.

Table VI—Costs of Fine Grinding per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.087	$0.186	$0.190	.....	$0.463
1918	0.085	0.240	0.205	.....	0.530
1919	0.083	0.212	0.180	.....	0.475
1920	0.082	0.153	0.208	0.009	0.452
1921	0.074	0.158	0.242	.....	0.474
1922	0.063	0.157	0.196	.....	0.416
1923	0.070	0.168	0.230	0.001	0.469
1924	0.083	0.203	0.246	.....	0.532
Average	$0.077	$0.182	$0.209	$0.001	$0.469

The cost was $0.006 per ton milled.

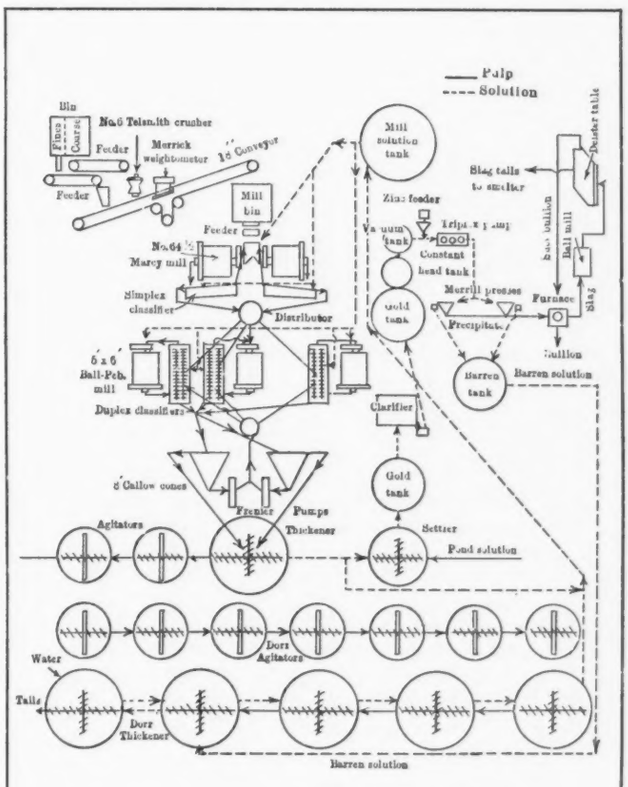
The overflow from the Callow cones had an average specific gravity of 1.12, or a consistence of 4.5 parts of solution to 1 part of solids. This pulp flowed to a 40x12 ft. Dorr thickener and was thickened to a gravity of about 1.44 or a consistence of 1 part of solution to 1 of solids. The capacity of the cyanide plant was about 325 tons per twenty-four hours. At this rate the settling area was 3.87 sq.ft. per ton milled.

The underflow from the primary thickener was pumped by a duplex Campbell & Kelly No. 4 diaphragm pump to the first of a series of nine Dorr agitators, seven of which were 24 ft. in diameter and 14 ft. in depth and two of which were 24 ft. in diameter and 16 ft. deep. The pulp from the last agitator flowed by gravity to No. 2 thickener, where it was throughly mixed with the overflow solution from No. 3 thickener. The flow from No. 2 thickener to No. 6 or the final thickener was counter current, fresh water being added to the last tank and barren solution to the one preceding it.

Table VII—Ball-Pebble Mill Liner Consumption

1917 to 1918	Feed End Chrome Steel	Throat Chrome Steel	Shell Chrome Steel	Discharge End, Including Grates	Total Cost per Ton
Pounds per ton milled	0.040	0.007	0.115	0.022	.....
Scrap, per cent	52	40	28	40	.....
Cost per ton milled	$0.0072	$0.0012	$0.0218	$0.0045	$0.0347
1919 to 1920					
Pounds per ton milled	0.031	0.004	0.185	0.022	.....
Scrap, per cent	35	41	24	40	.....
Cost per ton milled	$0.0063	$0.0009	$0.0234	$0.0045	$0.0351
1921 to 1924	Cast Iron	Cast Iron			
Pounds per ton milled	0.020	0.008	0.140	0.021	.....
Scrap, per cent	38	43	25	40	.....
Cost per ton milled	$0.0020	$0.0008	$0.0229	$0.0045	$0.0302

The air for agitation was furnished by two belt-driven Ingersoll-Rand compressors, Class ER-1, size 9x8 in. The consistence of the pulp during agitation was about equal parts solution and solid. The pulp flow from one thickener to another was regulated by varying the speed and stroke lengths of the diaphragm pumps. The



Flow sheet of United Eastern cyanide plant

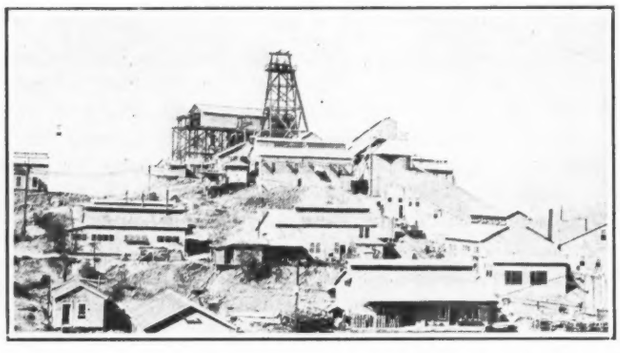
Pulp flow is indicated by full lines; that of solution by dash lines. The capacity is 325 tons per day.

cyanide was added to No. 1 agitator, where the strength was carried at 2.5 lb. of cyanide per ton of ore.

Table VIII—Costs of Cyaniding per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.121	$0.458	$0.088	.....	$0.667
1918	0.112	0.355	0.115	$0.002	0.584
1919	0.109	0.308	0.120	.....	0.537
1920	0.106	0.253	0.144	.....	0.503
1921	0.092	0.266	0.170	.....	0.528
1922	0.075	0.212	0.126	.....	0.413
1923	0.090	0.248	0.142	.....	0.480
1924	0.103	0.216	0.211	.....	0.530
Average....	$0.100	$0.289	$0.134	.....	$0.523

The solution overflowing the primary thickener ran to a sump from which it was pumped for clarification through a Merrill central-sluicing, clarifying filter, with twenty-eight frames 42 in. square. The press was sluiced once or twice every eight-hour shift as occasion demanded, and was acid treated about every three days with a 1 per cent solution of hydrochloric acid. Sluicing took ten minutes and the acid treatment about one hour. The solution leaving the clarifying press flowed to a steady-head tank of the Crowe vacuum system, from which it was drawn by vacuum into a 4x10-ft. receiver having a 6-in. inlet at the center of the top. This was 23.4 ft. above the solution level in the steady-head tank. Upon entering the vacuum receiver the solution poured down over a series of perforated trays, thus aiding the vacuum in liberating and removing the air from the solution. Within the receiver, the solution level was kept at a height of about 30 in. by a float operating a butterfly valve in the intake pipe. The solution was drawn from the bottom of the receiver by a 7x8-in. triplex precipitation pump. The glands of the pump were 32.8 ft. below the solution level in the receiver. This column of solution under vacuum insured a slight pressure at the pump glands and did not allow the drawing in of any air at that point.



Close-up view of mill and cyanide plant

Table IX—Costs of Clarification per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.003	$0.020	$0.007	.....	$0.030
1918	0.002	0.031	0.013	.....	0.046
1919	0.005	0.024	0.014	.....	0.043
1920	0.001	0.020	0.012	.....	0.033
1921	0.001	0.016	0.011	.....	0.028
1922	0.001	0.019	0.012	.....	0.032
1923	0.001	0.012	0.011	.....	0.024
1924	0.000	0.014	0.013	.....	0.027
Average....	$0.002	$0.020	$0.011	.....	$0.033

The zinc dust was fed by a screw feeder directly to a cone from which it was drawn by the precipitation pump, and mixed with the vacuum treated solution. The solution and zinc were pumped to two Merrill precipitation presses. Each press contained thirty-two triangular 36-in. plates, each of which was dressed with four thicknesses of sheeting. In cleaning up, the precipitate was scraped from each outer layer, and a new layer placed next to each plate. The cloths from which the precipitate had been scraped were then burned and the ashes mixed with the precipitate before fluxing. When necessary to clean a press, the solution was shut off, and, after draining, compressed air was blown through for a period of from sixty to ninety minutes. This dried the precipitate to a moisture content of about 45 per cent. At this consistence the precipitate was conveniently handled and required no further drying before fluxing and melting.

Table X—Costs of Precipitation per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.004	$0.127	$0.024	.....	$0.155
1918	0.005	0.092	0.018	.....	0.115
1919	0.005	0.063	0.019	.....	0.087
1920	0.004	0.055	0.023	.....	0.082
1921	0.005	0.057	0.022	.....	0.084
1922	0.004	0.051	0.016	.....	0.071
1923	0.005	0.074	0.017	.....	0.096
1924	0.004	0.053	0.021	.....	0.078
Average....	$0.004	$0.071	$0.020	.....	$0.095

The precipitate flux consisted of 12 per cent borax glass, 12 per cent sodium bicarbonate, 6 per cent manganese dioxide, 3 per cent bottle glass, and 10 per cent or more of slag shells from previous melts. The percentages given are based upon the calculated dry weight of the precipitate. After fluxing, the precipitate was put into No. 8 paper bags and fed to a tilting furnace. This furnace was a Case No. 150, using No. 125 long-lipped graphite crucibles. When ready for pouring, the crucible contained from 600 to 1,000 oz. of bullion and 40 to 50 lb. of slag. The molten charge was poured into a conical mold and allowed to set a few minutes before tapping off the slag. The slag was run into water for granulation. The bullion buttons were remelted and cast into bars of an average weight of about 1,800 oz. The granulated slag contained about 25 oz. of gold and 20 oz. of silver per ton. It was ground in a small ball mill. The shot bullion was concentrated upon a small Deister table for remelting during a subsequent precipitate melt.

Table XI—Costs of Refining per Ton of Ore

Year	Labor	Supplies	Power	Miscellaneous	Total
1917	$0.048	$0.071	$0.001	.....	$0.120
1918	0.047	0.037	0.001	$0.001	0.086
1919	0.042	0.030	0.001	.....	0.073
1920	0.040	0.031	0.001	.....	0.072
1921	0.032	0.042	0.002	.....	0.076
1922	0.026	0.027	0.002	.....	0.055
1923	0.028	0.028	0.001	.....	0.057
1924	0.027	0.013	0.000	.....	0.040
Average....	$0.037	$0.036	$0.001	.....	$0.074

As the pulp tailings left the mill they were distributed to the various ponds or benches through 6-in. slip-joint pipes having a minimum grade of 3 deg. Seven benches were in use. Each was built up to a height of from 8 to 12 ft. and then allowed to stand for a period of several months, during which time there accumulated a layer of salts of sufficient value to be gathered. Normally, about three of these "crops" could be gathered before the deposits became so low grade as to make their treatment unprofitable. The tailings were then turned back upon the bench and another layer of 8 or 12 ft. was built up. The skimmings were transported to the mill by autotruck. After sampling, they were dumped into a bin from which they were fed to the regrinding mills.

The following is a typical chemical analysis of the material retreated:

Constituent	Per Cent	Constituent	Per Cent
Water	13.81	Sodium chloride	11.10
Silica	47.75	Iron	Trace
Calcium carbonate	23.47	Thiocyantes	Trace
Sodium carbonate	0.37	Cyanides	None as such
Sodium bicarbonate	2.81	Alumina	Trace
Sodium sulphate	4.60		

Table XII—Recapitulation of Costs of Milling per Ton of Ore

Year	1917	1918	1919	1920	1921	1922	1923	1924	Average
General	$0.170	$0.183	$0.173	$0.166	$0.171	$0.118	$0.156	$0.172	$0.161
Lighting expense	0.008	0.009	0.005	0.004	0.005	0.004	0.004	0.005	0.005
Water supply	0.109	0.103	0.082	0.106	0.088	0.146	0.121	0.055	0.108
Coarse crushing	0.059	0.082	0.050	0.054	0.059	0.043	0.047	0.053	0.055
Coarse grinding	0.285	0.346	0.375	0.385	0.339	0.364	0.360	0.424	0.356
Fine grinding	0.463	0.530	0.475	0.452	0.474	0.416	0.469	0.534	0.469
Cyaniding	0.667	0.584	0.537	0.503	0.528	0.413	0.480	0.530	0.523
Tailing disposal	0.030	0.022	0.021	0.053	0.020	0.015	0.019	0.025	0.025
Clarification	0.030	0.046	0.043	0.033	0.028	0.032	0.024	0.027	0.033
Precipitation	0.155	0.115	0.087	0.082	0.084	0.071	0.096	0.078	0.095
Refining	0.120	0.086	0.073	0.072	0.076	0.055	0.057	0.040	0.074
Sampling	0.005	0.003	0.002	0.002	0.004	0.002	0.003	0.001	0.003
Assaying	0.035	0.032	0.028	0.033	0.039	0.021	0.033	0.033	0.031
Retreating skimmings	0.004	0.013	0.011	0.021	0.004	0.019	0.009	0.042	0.014
Mill heating	0.015	0.044	0.040	0.040	0.020	0.030	0.029	0.022	0.031
Solution recovery system	0.002	0.014	0.012	0.017	0.008	0.006	0.007	0.009	0.010
Experimental work	0.000	0.003	0.001	0.000	0.001	0.000	0.001	0.001	0.001
Total	$2.157	$2.216	$2.015	$2.023	$1.948	$1.755	$1.915	$2.051	$1.994

Table XIII—Average Milling Costs per Ton of Ore, 1917 to 1924

Labor	Supplies	Power	Miscellaneous	Total
$0.507	$0.831	$0.593	$0.063	$1.994

Table XIV—Consumption of Supplies, Pounds per Ton of Ore

Year	Sodium Cyanide, Aero Brand Cyanide	Zinc	Dust	Lime	Five-Inch Balls	Two-Inch Balls
1917	0.722	.....	0.548	4.150	0.925	2.120
1918	0.747	.....	0.388	4.930	0.929	2.140
1919	0.639	.....	0.306	4.592	1.140	1.880
1920	0.649	1.842	0.297	5.350	1.066	1.833
1921	0.732	1.760	0.341	5.569	0.915	1.864
1922	0.740	1.603	0.334	4.665	1.033	a2.012
1923	0.796	1.589	0.409	5.427	1.202	a2.811
1924	0.737	1.728	0.373	4.715	1.331	a2.806
Average	0.713	1.675	0.368	4.849	1.049	2.013

a Cast iron.

Table XV—Power Consumption, per Ton of Ore

Operation	Kw.-Hr.	Operation	Kw.-Hr.
Mill lighting	0.090	Clarification	0.317
Coarse crushing	0.445	Precipitation	0.701
Coarse grinding	6.709	Refining	0.001
Fine grinding	8.597	Solution recovery	0.116
Cyaniding	6.045		
Total			23.021

Table XVI—Summary of Tonnage and Extraction

Year	Tons Milled	Heads	Tails	Extraction, Per Cent
1917	84,548	$22.423	0.806	96.41
1918	92,339	23.158	0.706	96.95
1919	97,325	20.874	0.627	96.99
1920	102,926	21.760	0.696	96.80
1921	97,413	20.260	0.652	96.78
1922	117,687	13.922	0.535	96.15
1923	104,800	19.876	0.857	95.69
1924	35,490	14.510	0.609	95.80
Totals and averages	732,528	$19.803	0.676	96.59

A reservoir below the tailing pond collected the seepage. This solution assayed from 20c. to 40c. per ton. It was pumped back to the mill to be precipitated or used as a wash, as desired. A total of about eighty tons of this solution was returned to the mill every twenty-four hours.

An Idyl of the Cornish Tin Mine

THE following, from *The Ironmonger*, paints a somewhat dreary picture of the present state of England's once famous tin mines:

"When a visitor to western England travels along the granite spine of the peninsula of Cornwall, his interest is infallibly aroused by the deserted tin mines which are scattered everywhere over the landscape. Each stretch of purple-heathered moor has its ruined engine house, with its chimney from which smoke long ago ceased to curl; and almost every eminence that rears itself against the sky-line is crowned by a pile of gaunt, derelict masonry that looks like a feudal keep.

"For safety's sake many of the shafts have been artificially choked by blasting. Some, however, remain unguarded save for a low stone hedge. Others have not even this protection: their mounts, fringed with fern or bracken, remain as cavernous memorials to an age when English tin supplied half the world's demand.

"Near Camborne and Redruth numbers of mines are still working. The massy pumping beams wheezily rise and fall; sky and buildings are dull; and, in the streets every other man is a Cousin Jack—that is, a miner. This district is a living picture of what all the mining tracts were when Victoria was a girl queen and competition from Perak or Selangor, in distant Malay, was unknown. Nature has sided against Cousin Jack, for while Cornish ore must be won by hewing living granite, the granite of Asia, softened by ground water in tropical conditions, is easily cut by Chinese miners.

"On a lonely hillside, a few miles from St. Ives, stands the famous old Ding Dong mine. There are rumors that it will be reopened; but after climbing the gorse-clad slopes and marking the desolate engine house and grass-grown spoil banks, one feels that Ding Dong's day is over. The chimney and the house belong to a far-off state of things. They take their place as landmarks with the near-by stone circle of the Nine Maidens and the Lanyon Quoit, where, two thousand years ago, a savage chieftain was buried.

"Beneath Ding Dong, and many another old Cornish mine, are hidden thousands of tons of tin. There, probably, it will remain until the time when King Arthur, throwing aside his disguise of a red-beaked chough (to which all good Cornishmen doff their hats) comes again to his land. And that time lies in the indefinite future which mortal men call—never."

Simplified Practice

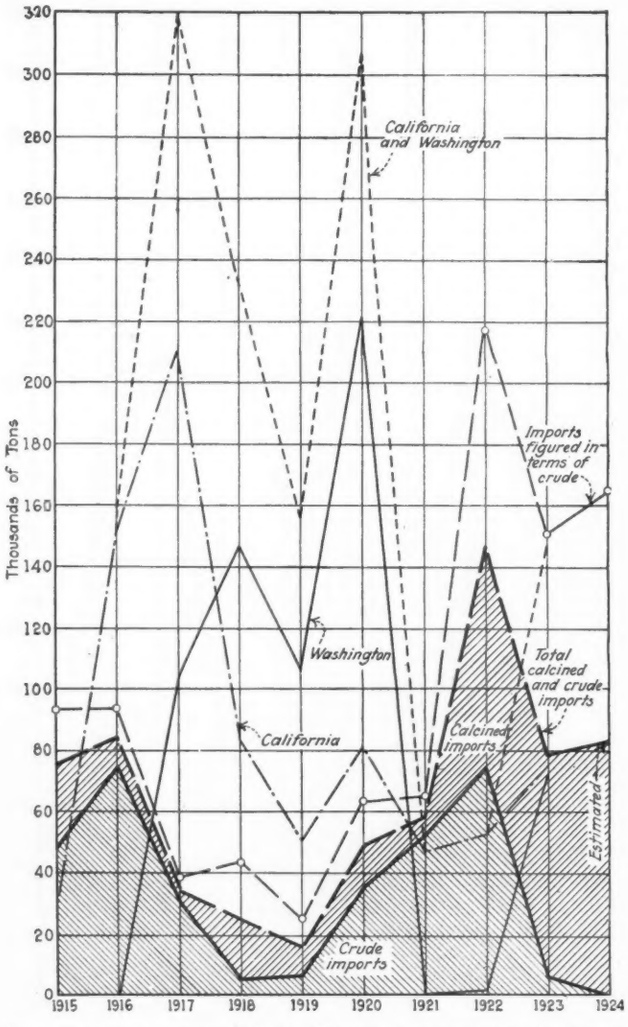
"Thee naws, o course, baout this 'ere new pump we be puttin h'in h'on tha twelve 'underd level," said Cap'n Dick. "Dam-me, h'it be a 'andsome bit o work too, fixed h'up with tha latest o these 'ere contrapshuns so that tha bloody thing gaws h'on workin w'ether h'it likes h'it h'or no. Jus' tha sort o pump that 'Arry Trembath would get. One day one o these 'ere salesmen chaps come to see 'Arry baout a pump that wuz needed h'at tha mine, an' started to tell 'im 'ow this an' that would 'ave to be done to keep un gawin an h'in good workin h'order. 'Gos long with ee,' sez 'Arry, 'I'm not runnin a repair shop—w'ot I want be a pump that thee can fix with a Stillson."

A Washington Magnesite Plant

How the Northwest Company Produces a Dead-burned Product of Refractory Grade Near Chewelah

By George J. Young
Associate Editor

THE MAGNESITE DEPOSITS near Chewelah, Wash., were first recognized in 1915, and war conditions subsequently stimulated their intensive development and utilization. At first the mixed character of the deposits was not realized, but, when it was, an exhaustive campaign of research was undertaken, and the technical difficulties at first encountered have now been overcome. Several companies acquired



The meteoric career of the domestic magnesite industry is indicated by this chart, which shows the fluctuations in production in Washington and California

California and Washington production are given in terms of crude magnesite; imports of crude and calcined in tons of 2,000 lb. —U. S. Geological Survey.

properties and operated for a time. The Northwest Magnesite Co. persistently attacked the problem, and is at present the only company in the district producing dead-burned magnesite. The American Mineral Production Co. built a number of kilns, but achieved an indifferent success and was finally acquired by the Northwest Magnesite Co.

The magnesite in the deposits is of the crystalline variety and occurs as replacements in association with a narrow zone of dolomite. The mineral varies from clean magnesite to magnesite in close association with calcite and dolomite. Thus the relative proportions of calcium and magnesium vary. Iron and silica content also vary. Color and general appearance is not a safe guide to distinguish clean from contaminated mineral, and therefore frequent analyses are necessary. The deposits are of such size as to warrant their commercial development on a large scale. The total production from 1916 to 1923 inclusive was 655,700 tons of crude magnesite, part of which was shipped in the crude condition and the greater part as calcined magnesite.

At the time that I visited the Northwest Magnesite Co.'s plant, in July, 1924, one kiln was being operated and the production was about sixty tons of dead-burned magnesite of refractory grade per day. The Finch quarry was being operated on a commensurate scale. At the quarry several benches have been opened out. The crude magnesite is drilled by Jackhamers and blasted. It is picked and loaded by hand into cars and delivered to the crushing and washing plant. An electrically operated caterpillar tractor shovel is part of the quarry equipment. The wide variation in composition of the material quarried necessitates chemical control, and the work of the quarrymen is closely supervised. The magnesite is delivered to the crusher bin and crushed by a 24x15-in. jaw crusher which discharges to a conveyor leading to scrubbers and trommels. Under ¼-in. size is wasted and over 1-in. size is crushed further by two No. 5 Gates gyratory crushers. A bucket elevator delivers the product to a trommel, which delivers plus 2½-in. size to the gyratory crushers and undersize to an automatic sampler and a 300-ton bin. A five-mile wire-rope tramway delivers the product to the calcining plant, near Chewelah, where it is discharged into a 1,000-ton bin.

At the Chewelah plant a conveyor system delivers the coarse magnesite to the fine-crushing plant, in which it is crushed by rolls to minus 8-mesh size. Impact screens are used for sizing. The sized product is delivered to a 150-ton bin. The fine-crushing plant is equipped with Allis-Chalmers rolls 42x16 in. in size. Conveyors are 20-in. belts. Impact screens are of the Colorado type, 3 by 4 ft. and 4 ft. 3 in. by 4 ft. A magnetic pulley removes tramp iron in advance of the rolls. Belt feeders are used at the storage bin for establishing a uniform flow to the fine-crushing unit.

Iron ore containing approximately 80 per cent magnetite is mined from a locality north of Chewelah within three miles of the international boundary. As the mixture sent to the kilns contains only 2 per cent of iron ore, only a relatively small tonnage of iron ore is required, slightly over fourteen tons per day at full capacity and 2.4 tons per day when one kiln is in operation.

A separate installation for the preparation of the iron ore is in use. The iron ore is crushed by a 7x10-in. Blake crusher and delivered by a bucket elevator (which also receives cinder from the kiln) to a 3-ft. 6-in. by 30-ft. rotary drier. A screw conveyor delivers the product to a pair of 30x12-in. rolls. A bucket elevator receives the product and delivers to a sixty-ton bin. A 42-in. Fuller mill grinds the roll product. The final product is delivered by bucket elevator and screw conveyor to a forty-ton bin.

The prepared magnesite is weighed in one-ton hop-

A small electrically operated caterpillar-mounted shovel is part of the equipment at the Finch quarry

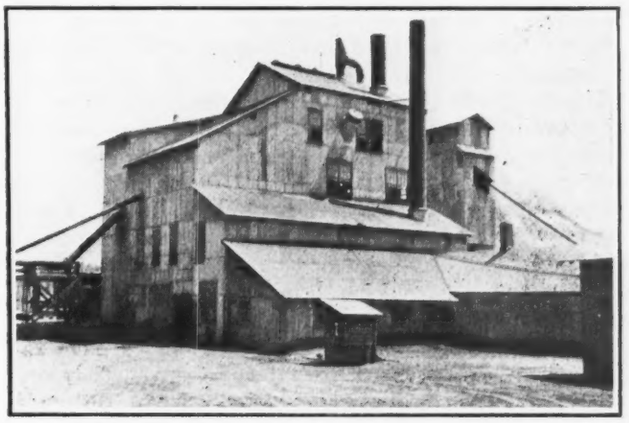
pers, two three-ton Fairbanks hopper scales being available. The hoppers deliver to a 20-in. belt conveyor and thence to a bucket elevator. A 16-in. belt conveyor distributes the product to six sixty-ton bins or to an auxiliary bin of 1,000 tons' capacity. The iron ore is weighed out in the proportion of 40 lb. to 1,960 lb. of magnesite and poured on the magnesite upon the 20-in. conveyor. Mixing is accomplished by the bucket elevator and conveyor leading to the kiln feed bins.

Individual belt feeders deliver a constant stream to the rotary kilns. The kilns are of the type used in cement plant. Five are 7½x125 ft. and one is 8x125 ft. Each pair of kilns discharges into a brick chamber, from which the hot material is elevated by a bucket elevator to a 5x50-ft. rotary cooler. The rotary kilns are fired by coal dust and the temperature is maintained as uniformly as possible at from 2,800 to 3,000 deg. F. Careful heat control is an essential factor in the success of the process, and every effort is made to maintain standard conditions.

The cooled product is delivered to an 18-in. conveyor, discharging into a bucket elevator that in turn discharges upon a grizzly (2-in. spaces), the oversize going to a pocket in advance of a 7x9-in. jaw crusher and from this to a pair of 30x16-in. rolls. The grizzly undersize is received in an eighty-ton bin. Impact screens size this material to minus ¾ in. The oversize goes to the rolls and the roll product to the bucket elevator discharging upon the grizzly. The minus ¾-in. product is conveyed by an 18-in. belt to an automatic sampler and thence to a 14-in. distributing conveyor to a storage warehouse, which has a capacity of 3,000 tons. A dragline scraper is used to reclaim the material and deliver it to a bucket elevator and twenty-ton pocket, which delivers by a chute to a car loader. Box cars are loaded by this device and are ready for shipment.

Rock crusher station and washing plant at quarry of Northwest Magnesite Co.

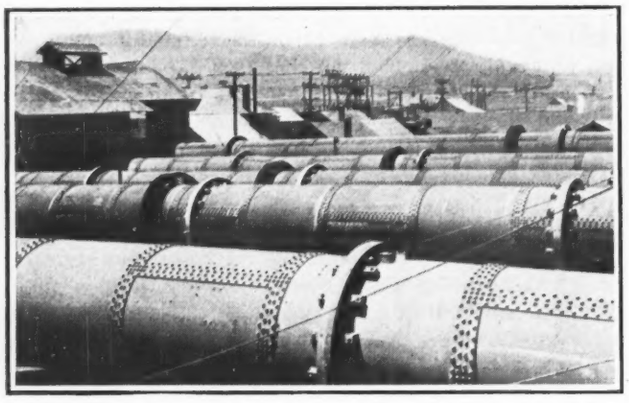
The coal-pulverizing plant receives the coal in a 150-ton pit from the cars. A screw conveyor and elevator deliver the product to a 600-ton concrete storage platform. Additional storage space is provided, and this is served by a drag-line scraper. A belt conveyor with magnetic head pulley delivers the coal from the platform to an elevator and past automatic scales to two Ruggles Coles 48-in. by 30-ft. direct-fired driers which deliver in turn to six 18-in. Bonnot pulverizers and separators. Six 45-in. exhaust fans with collectors remove the pulverized coal and discharge into a fifty-ton pulverized coal bin. Four 6-in. feed screws with automatic speed regulation deliver the pulverized coal to a 62-in. high-pressure fan that forces the coal to the burners or bypasses it back to the pulverized-coal bin. The gaseous products from the kilns are passed through a Cottrell treater to remove the dust. The treater formerly used at the Northport smelter has been installed and is in use at the plant.



Coal-pulverizing plant at the calcining works at Chewelah

An insight into some of the difficulties of exploiting non-metallic mineral deposits is afforded by a study of the present position of the Stevens County magnesite industry. The most promising outlet for the particular variety of magnesite is in the refractory trade. Much experimental work has been done in manufacturing a plastic magnesite product from crude Washington magnesite. I am informed that the American Mineral Production Co. succeeded in making a satisfactory material, but failed to develop a market for it. The result of the experimental work and the experience with the plastic magnesite marketed indicates that a plastic magnesite can be successfully made.

When the Northwest Magnesite Co. acquired the properties of the American Mineral Production Co. the management of the first-named company discontinued, for business reasons, the production of plastic magnesite. Although a high degree of technical success has been attained in the manufacture of a standardized high-grade dead-burned magnesite for refractory purposes, the product is in small demand in the West, as the



Rotary kilns for calcining crude magnesite at Chewelah. Five are 7½x125 ft. and one is 8x125 ft.

principal market is in the region east of the Mississippi. The Washington product must compete in that territory with imported dead-burned magnesite. Ocean freight rates plus inland rates to competitive territory favor the foreign material, which is produced under low-cost conditions. A tariff establishing a differential of $11.50 per ton for dead-burned and grain magnesite has only partly helped the domestic producer, as his operating costs necessarily conform to prevailing high costs of labor, materials, and supplies and high rates of taxation.

The meteoric career of the magnesite industry is indicated by the accompanying chart, which shows the fluctuations in domestic production in Washington and California. California produces principally caustic calcined magnesite and markets on the Pacific Coast and mid-continental territory. Dead-burned magnesite is also produced. Freight rates are the important factor in restricting Eastern markets for the California and Washington producers.

Both California and Washington producers have reduced their production costs to a minimum. They are therefore dependent upon the policy of the railroads in establishing freight rates. Eastern roads are interested in traffic originating within their territory. Through traffic rates from Western points require that rates be established jointly by Western and Eastern lines. Although some success has been obtained in obtaining favorable rates, lower through rates are needed to meet the present situation.

Acknowledgment is made of the courtesy of Roy N. Bishop, manager of the Northwest Magnesite Co., and his assistants, who facilitated my visit to their plant.

Lubrication of Mine Cars and Drills

The lubrication of mine equipment was recently discussed by E. H. Strange in a lecture before the Chemical, Metallurgical and Mining Society of South Africa. The lubrication of mine cars, he said, particularly where expensive man power is used, deserves attention. Quite often a car which has good bearings and is correctly lubricated can be pushed by one man, whereas, when the same car has poor bearings and is running dry it takes two men to push it. For a car with plain bearings a cheap black oil should be used, because most of the oil drips off and does no useful work. For a car with self-oiling bearings use a good quality, low cold test oil, and for a car with roller bearings use a semi-fluid grease.

All rock drills are likely to freeze, due to the moisture in the air, and the small winding passages from the exhaust valves. Most drill runners wait until a drill runs dry before they oil it, and it is important that drill runners be taught to oil a drill at regular intervals, so as to avoid freezing of the moving parts, particularly in the hammer type of drill, as these parts operate at very high speed. An oil for air drills should have a low cold test not above 15 deg. F.

Use of Dolomite in the Cyanide Process

The results of experiments in the use of calcined dolomite as a substitute for lime in the recovery of gold and silver by the cyanide process, made by the U. S. Bureau of Mines, indicate the following:

1. In regular cyanide practice, where cyanide solution is to be used repeatedly for extracting fresh batches of ore, the magnesium oxide content of calcined dolomite cannot be used advantageously *to neutralize acidity.*

   (*a*) Where an excess of calcined dolomite is used to prevent the building up of magnesium salts in solution, the magnesia content takes no part in the reaction.

   (*b*) If just enough calcined dolomite is used to neutralize acidity, magnesium salts will build up and eventually form a saturated solution in which the cyanide loss would be high unless an unusual amount of "bleeder" solution is run to waste.

2. In the cyanide treatment of certain ores calcined dolomite may be substituted for lime with profit.

   (*a*) Calcined dolomite is as effective as lime in preventing cyanide loss.

   (*b*) Calcined dolomite nearly parallels lime in its precipitating and settling effect and causes no difficulty in filtration of the solution or in the precipitation of silver by zinc.

   (*c*) Calcined dolomite equals lime in the quantity of precious metals recovered.

3. In treating certain ores by the cyanide process, the recovery of silver with the use of calcined dolomite as an alkaline agent is not equal to that obtained with the use of lime.

4. The use of the magnesia content of calcined dolomite would therefore be confined to neutralizing acidity and aiding settlement where the ore is crushed in water for amalgamation prior to cyanide treatment and in cyanide practice where the solution could be discarded or "bled" sufficiently to keep down excess of magnesium salts.

Calcined dolomite should not be purchased as a substitute for lime in the cyanide process without a thorough investigation as to its action on the ore to be treated and its effect on all operations.

Volumetric Determination of Zinc

A note by K. Kilpes in the *Chemiker-Zeitung*, abstracted in *Chemistry and Industry*, states that the end point in the usual sulphide titration of zinc with external or internal indicator is not very sharply defined; better results may be obtained by adding an excess of sodium sulphide solution, heating the mixture to boiling, filtering off the zinc sulphide, and titrating the excess of sodium sulphide in the filtrate with iodine after cooling and acidifying with acetic acid.

What Forestry Means to the Mining Industry

Government Practice on the Reserves Is Explained, With Particular Reference to Those in the State of California

By T. D. Woodbury
Assistant District Forester, U. S. Forest Service

IN 1923 THE MINES OF CALIFORNIA employed about 7,500 men and produced about 1,450,000 tons of mineral products, disregarding cement and petroleum. Timber is used in nearly every phase of mining, and the prosperity of this important industry is dependent to a considerable extent on an adequate, continuous supply of timber from the forests of the state.

In view of the relationship above set forth, a few forest facts should be of interest. California contains 13,000,000 acres of forest land bearing an estimated stand of 284,000,000,000 ft., board measure. This is about 15 per cent of all the remaining virgin timber in the United States. The forests of California contain enough lumber to lay a board floor, one inch thick, over the entire states of Massachusetts and Rhode Island.

A Forest Service sale area after timber has been cut and brush piled for burning

Cutting practice on the national forests results in leaving from 15 to 20 per cent of the trees more than 12 in. in diameter at a point 4½ ft. above the ground. The timber left will provide a future harvest as well as a seed supply for restocking the openings caused by cutting.

Approximately one-third of the timber in the state, or 96,400,000 ft., board measure, is within the national forests. These forests are situated in practically an unbroken belt along the Sierra Nevada from Kern County northward to the Oregon line and in the Coast Range north of San Francisco. They are managed with the object of insuring a perpetual supply of timber and of preserving the forest cover to regulate the flow of streams upon which the state is dependent for irrigation water and power; they are regarded as public resources to be held, used, protected, and developed by the people for the people.

The opinion is all too prevalent that conservation means hoarding and that these vast timbered areas are idle lands. This is far from the truth. The national forests of California are one of the big business enterprises of the government that pays for itself. During the fiscal year ending June 30, 1924, there was turned into the Federal Treasury $1,241,605 from timber sales, livestock grazing, and other forms of uses of the seventeen national forests of the state. The expenditures for the administration and protection of the forests for the same period amounted to approximately $985,000, leaving a credit balance of more than $250,000. The amount received from the sale of timber was $910,970, and from fees for the grazing of cattle and sheep $250,000. Water-power rentals brought in $43,000 and other special uses $91,000.

The two principal objectives in the governmental policy for handling the national forests are, first, production of as much wood for the future as possible and, second, utilization of the timber now ripe without waste. Uncle Sam does not harvest the forest crop of ripe timber himself. This is done by lumbermen and others who buy timber from the national forests which must be cut in accordance with the terms of carefully prepared contracts.

The law requires that timber sold the value of which is more than $100 shall be first advertised for at least a thirty-day period. Awards are made to the highest bidder except under unusual circumstances, when it appears clear that such an award would not be in the

Typical fire lookout station of the U. S. Forest Service, in the Sierras

public interest. All stumpage advertisements set forth the minimum price below which the timber will not be sold. This price is carefully determined in each case by an appraisal made by a competent man. This appraisal takes into account the investment in sawmill, transportation facilities, and other items necessary in the conversion of the timber into lumber; the species of timber, its quality, and all operating costs from stump to lumber in pile. The average price at which the lumber can be sold is then carefully estimated and a fair profit on investment is allowed. Operating cost, plus depreciation and margin for profit and risk, are subtracted from the average estimated realization figure, and the difference obtained is taken as an indication of stumpage value.

Following the award of the timber, a carefully prepared contract is drawn up for the signature of the successful bidder. This contract specifies the time allowed for the cutting and removal of the timber, the amount of deposits in advance of cutting, and the manner in which the timber will be cut and handled. Care with fire in the woods is emphasized and provision is made for requiring the operator to furnish assistance in fighting fires which may occur.

Government and Private Owners Harvest Differently

There is a right time and a right way to harvest a timber crop. Many trees in our California woods should have been cut and utilized years ago. These are the trees with flat tops and large dead branches, which often show by the fungus fruiting bodies on them (conks) that they are fast becoming worthless. Many other trees, though big enough to make saw timber, should not be cut for some time, because they are putting on wood at a fast rate. These are the smaller limby trees with pointed tops and black bark. Now, right here comes in one of the main differences between the forestry practice followed by the government on the national forests and the practice of harvesting the forest crop on private lands. The government employs foresters who select carefully each tree to be cut, with the object of removing the ripe timber now and leaving the rapidly growing trees to make up a second cut. The private owner, as a rule, cuts all of the timber on the area which he feels he can manufacture at a profit. The young trees left on the government land after cutting serve a double purpose. Not only do they provide a future harvest, but they also furnish a seed supply which results in the natural restocking of the openings created by the removal of the mature trees.

As a rule, the cutting practice on the national forests results in leaving from 15 to 20 per cent of the timber that is more than 12 in. in diameter at a point 4½ ft. above the ground, which means leaving from 2,000 to 10,000 ft., board measure, per acre. It is the plan of the government to cut over the timbered areas on the national forests every fifty or sixty years. The trees more than 12 in. in diameter now left on cut-over areas will then be 22 to 24 in. in diameter and will furnish a profitable second cut after most of the timber land owned by the lumber companies has been cut over. The third cut, which will be started about 120 years from now, will consist largely of the trees which develop from the young seedlings which we see today under the big timber and in the openings in the forest.

What the Forest Fire Does

With the above objectives in mind, it is not difficult to understand why the government spends large sums annually fighting fires which occur on the national forests, and in destroying tree-killing beetles. In addition to killing much mature timber that is ready for harvesting and has a present value, fires destroy practically all of the young seedlings that should make the basis of the third cut in about 120 years and a very large part of the middle-aged trees which we are depending on to make up the second cut in sixty years. It takes a long time to grow trees to cutting size, and unless fire and other devastating forest influences are controlled, lumber for mining, or any other use, will be scarce and high fifty years from now.

Because of the large size of California timber, it is generally necessary to use steam machinery in logging. The donkey engines employed burn wood, which brings a fire menace into the forest. To control this menace, lumbermen who cut government timber are required to equip each donkey engine with a spark arrester and a handy supply of pails, shovels, and axes for fighting fires. A force pump and 200 ft. of fire hose must also be a part of the equipment on each machine. All inflammable material must be cleared for 100 ft. in all directions. Oil is required as fuel in logging railroad locomotives.

Beetles do as much damage to timber as fires, although this damage is not as easy to see. The foliage of the trees that are infested with beetles turns yellow, and the trees die soon after this occurs. The government spends a good deal of money each year in the national forests cutting such trees, peeling their bark, which contains the beetles and their young, and destroying the bugs by fire. This work is done in the spring and fall when the woods are wet and before the young beetles leave the trees. Each timber sale contract contains a clause which requires the purchaser to cut all insect-infested trees under the direction of a forest officer.

Timber Waste Avoided in Cutting

Foresters believe that a thousand feet of timber saved is as good as a thousand feet grown; therefore all government timber sale contracts require that every tree cut shall be fully utilized. It is required that stumps shall not be cut higher than 18 in. and the tops of trees shall be utilized to the 10-in. point. Pine logs that are one-third merchantable and logs of other species that are one-half merchantable must be logged. Even under

these requirements there is a large waste in limbs and tops, which cannot be avoided at present because there is no profitable sale for such material. The Forest Service is constantly looking for a profitable market for this waste, for every foot of wood waste that can be prevented now means just so much added to our future supply of this necessary product.

In addition to fire and beetles a good deal of young timber is destroyed by donkey logging. Young trees often have their bark or limbs knocked off or are uprooted by incoming logs. Trees seriously injured grow very slowly for some time and those knocked over are a total loss. All this sort of thing reduces the future crop, and logging methods are therefore carefully regulated on the national forests so as to prevent unnecessary damage. The best type of logging from the forestry viewpoint is horse logging, because this method does not bring fire into the woods or demolish young trees left for a future cut.

Logging with donkeys

This method is responsible for the destruction of considerable young timber. Trees often have bark or limbs knocked off, or are uprooted by incoming logs.

The cutting of timber results in leaving a large amount of brush on the ground, which, if not disposed of, is likely to catch fire during the dry season and destroy the timber left on the area. On this account the Forest Service requires that all brush which results from cutting on timber sale areas shall be piled in compact piles for burning during the rainy season. These piles must be placed as far as possible from live timber, so as to prevent damage when they are burned. The burning is done carefully under the direction of forest officers with the purpose of protecting the young trees on the area from the flames.

When fires do occur in our forests it is difficult to put them out if there are standing dead trees on the area. The fire runs up these trees, and sparks are scattered from their tops over a wide range of territory. For this reason, all standing dead trees on sale areas must be cut by timber operators. The cost of this work to the operator is taken into account in fixing the price of the stumpage.

Green trees which are badly diseased and covered with conks must also be cut to prevent the spread of disease to healthy trees near by, just as people suffering from diseases that are "catching" must be kept isolated for the good of others. All of the measures detailed in the foregoing paragraphs have for their object the maximum production of wood from the national forests, both at the present time and in the future. The regulations that have been formulated and enforced are in the interest of the public.

Mineral Land Open to Entry in National Forests

Congress and the Secretary of Agriculture have dealt liberally with the mining industry in respect to the use of the national forests. Lands within these areas which contain valuable deposits of minerals may be located under the general mining laws in the same manner as on the unreserved public domain. No other land is subject to entry within national forests except small areas classified as valuable chiefly for agriculture. The regulations formulated by the Secretary of Agriculture governing the use of the national forests provide that $20 worth of wood may be obtained annually from them by miners and prospectors for minerals, for uses connected with the development of their mines or mining locations. Free use permits, which may be obtained from forests rangers, are required. These provide for the cutting of designated live trees only, close utilization, brush disposal, and care with fire. Dead wood for fuel or other uses may be freely taken without permit.

Mining locators may use timber from their locations for any purpose which aids in the removal of ore from the ground. When a group of claims is involved, the work in connection with which the timber is used must promote the development of the claim from which the timber is taken. Timber cut from locations, under the above right, may be used in underground workings and in constructing necessary improvements for the housing and convenience of employees engaged in mining. It cannot be used, however, in the construction of tramways for transporting ore, in constructing stamp mills, or for any other purpose that has to do with the treatment of the ore after removal from the ground. For these purposes, necessary timber may be purchased at reasonable rates, usually from near-by

Logging with big wheels on a Forest Service timber sale area

Horse logging is the best method from the forestry viewpoint, as it does not bring fire into the woods or demolish young trees.

national forest land or from the claim itself with the consent of the locator.

In connection with the administration of the national forests in California, abuses of the mining laws or the Secretary of Agriculture's regulations are occasionally discovered. Some years ago, just before the completion of a transcontinental railroad through one of the most heavily timbered of the national forests in this state, 265,000 acres of excellent timber was located under the mining laws along this proposed railroad line. In course of time, all of these locations were shown to be invalid, and none of the land was patented. Much time and money was thrown away in this effort to obtain timber land under cover of the mining law. Instances are also on record of efforts to secure valuable reservoir sites, hotel, store, residence, and recreation areas in the same way.

Efforts are sometimes made by "ambitious" locators to block the sale of national forest stumpage by locating invalid claims on timber tracts which are about to be offered for sale by the government, with the evident expectation that the prospective purchaser will make it worth while for the locator to relinquish. These attempts are generally unsuccessful. They usually result in friction between timber operators and mining locators. Unfounded criticism of Forest Service policy and procedure also sometimes follows. Mineral locations on areas of national forest timber that have been advertised for sale do not give the locator any right to the free use of the timber for mining purposes.

In some instances, timber on mining locations has been cut and sold. This practice is, of course, illegal, except in connection with placer mining when it is necessary to clear the ground to be mined. In such cases the courts have ruled that the mining operation must follow closely the cutting of the timber.

It is the desire of the Forest Service to promote legitimate mining in every possible way and to facilitate the development of valid claims, which are interpreted to be those initiated in good faith under the mining laws and continued by use consistent with the character of the claim and necessary for its actual development. Invalid claims initiated as a pretext for securing timber or other valuable rights not connected with mining hinder National Forest administration and would disintegrate our whole National Forest structure in time, if not eliminated. In no case, however, is adverse action taken against a mining claim except upon recommendation of a mining engineer who has made an examination of the claim.

Porphyries of the Porcupine Area

By L. B. Wright

Chief Geologist, Homestake Mining Co., Lead, S. D.

AFTER SPENDING the greater part of four months in a study of specific localities and the area in general in and around the Porcupine district, Ontario, I observed certain features in connection with the porphyries therein which to my knowledge have not been recorded, although without doubt observed by many.

It is well known that a great amount of capital has been expended by many companies and individuals in shaft sinking and diamond drilling in this area, in what seems to be geologically favorable localities, without, so far as is known, material success except almost within the property lines of the several producing operations. Outcrops which to all appearances are identical with those which marked the discovery of the leading producers have been explored in nearly all cases without material reward. They usually occur in the Keewatin basaltic and andesitic schists in the form of quartz veindikes and in close proximity to masses and dikes of porphyry and in some cases as carbonates with quartz impregnating in irregular fashion broad shear zones. The question forcibly asserts itself, why are these veins and masses of vein material not commercially auriferous? The porphyries, believed to be of Algoman age, must in some manner hold the answer.

The first striking feature of the Hollinger, McIntyre and Dome quartz porphyries is the intense schisting and sericitization as opposed to other porphyry stocks, sills, and dikes in the district which have been generally accepted as being of Algoman age also. One writer attributes the schistosity to cooling influences, observing that the schistosity is parallel to the major axes of the masses. This explanation then must be limited to the schistose masses and another offered for those which lack schistosity. The latter, from their texture could not have cooled under conditions dissimilar to the schisted masses.

If, as is generally accepted, these porphyries were intruded during Algoman time, it seems quite reasonable that those which are now more schistose and hydrothermally altered were intruded during, if not quite early in, this mountain-building period. That there was intense folding and contortion on a colossal scale at this time is well demonstrated in many areas of Pre-Cambrian rocks by the major structural features, especially folding. A number of instances were observed in the Hollinger mine where the quartz porphyry, after having been rendered schistose and having reached a temperature below that which would permit of flowage with some schisting under the orogenetic forces then prevalent, has been fractured in zigzag fashion along definite planes not always parallel to the general strike of schistosity. Also, the gold-bearing quartz veins have been faulted in some cases with a throw of thirty feet. This feature points to a later disturbing influence, which is most logically accounted for, in part at least, by certain of the later massive feldspar porphyries. These porphyries outcrop prominently, having offered great resistance to glaciation. They are characterized by a fairly well-developed fracture system largely impregnated with quartz and some sulphides; and might, for the purpose of this discussion, be designated as the Second porphyry in order of intrusion; and at this point it may be well to suggest that the gold-bearing veins of the district were formed as a result of and after the intrusion of the First or quartz porphyry (as H. S. Robinson has pointed out in his "Geology of the Pearl Lake Area," in *Economic Geology* of December, 1923) and just preceding the intrusion of the Second or feldspar porphyry, and also that the Algoman disturbances were in the closing stages, which supposition is evidenced by the lack of pronounced schistosity in the Second porphyries and the relatively minor ex-

tent of folding or contortion of the gold-bearing quartz veins themselves.

There is a later, or Third, intrusion of feldspar porphyry, observed in the form of narrow dikes occurring most prominently in the southern part of the area in Deloro Township. These dikes, though similar in texture and composition to the Second feldspar porphyry, have not been affected by any great disturbing influence. They are massive, and the only fractures observed were due to jointing, normal to the strike.

To sum up, the auriferous quartz veins were formed between the First and Second intrusion periods, the Third following. It is not my purpose to convey the impression that the Second and Third porphyries did not give rise to auriferous solutions, but the results of exploration seem amply to confirm the conclusion that the amount of gold deposition in conjunction with these later intrusives was comparatively far less than was the case with the quartz porphyry. If this be true, it is highly desirable to differentiate and not to regard all of the intrusives in this district as of Algoman age and their accompanying bodies of vein material as being equally attractive subjects for "geological bets" in exploration.

Treating Mine Timber Pays

By Harry E. Tufft

ONE of the most effective ways in which mine operators can reduce timbering costs is to treat with a suitable preservative any timbers to be placed where replacement from decay is expected. A recent illustration of this may be drawn from the description of tests being conducted by a large copper mining company.[1] On the return-air courses, where the experiments were conducted, about one-half of the untreated timbers showed pronounced fungus and decay in one and one-half to two years after they were placed, and one-tenth to one-fifth had failed from decay in this same period of observation. Most were Oregon pine.

The timbers that had been treated with a wood preservative were practically all sound, except in a few instances where abrasion of the treated wood permitted fungus to gain a foothold. Though the results of the tests are far from complete, on account of the short time that experimentation has been under way, enough has been done to indicate there will be a decided saving by treating the timber.

The following estimate of the probable savings from treatment at this mine is based on the average cost of timber and timbering work in the district:

Let it be assumed that 100 untreated drift sets and 100 treated sets had been installed. In two years' time, ten of the untreated sets would be replaced, but the 100 treated would still be sound. For easy calculation, one drift set is considered as consisting of sawed timbers 8 ft. long and 10 in. square. One drift set would contain 200 board feet and require about 200 board feet of 2-in. plank lagging. With Oregon pine timber at $40[2] per thousand board feet delivered to the mine the cost in place is as follows:

Timbers (3 pieces, 200 board feet)			$8.00
Lagging and placing			5.00
Cost in place, one set			$21.00
100 untreated sets	$2,100	100 treated sets	$2,100
Replacing 10 sets	250	Cost of treatment	215
End of two years	$2,350	Cost in place	$2,315
Difference in interest charge, 6 per cent on $215 for two years			33
			$2,348

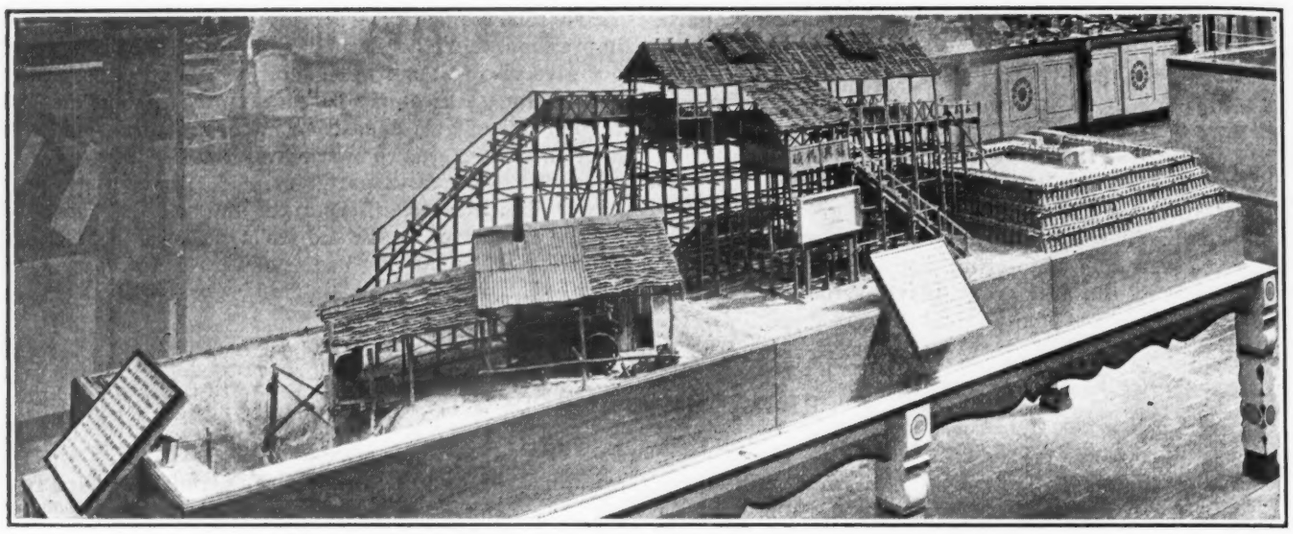
From this it will be seen that the amount of money expended on 100 treated sets and 100 untreated sets, the latter requiring ten sets to be replaced in two years' time, is approximately the same at the end of two years, with this difference in the results: All of the 100 treated sets are still sound and probably good for several years more, whereas of the 100 untreated sets only the ten new ones can be regarded as sound, fifteen to twenty-five are badly weakened and will soon have to be taken out, twenty-five or thirty-five are showing incipient decay, and the other forty sets, on which fungus growths were not visible as yet, are probably infected. The treatment costs and life of timbers are here given as found by actual observation in the test. The experience of this mine is only a passing example of what can be done when the mine operator begins systematic study of his timber problem.

[1]Marks, Leroy: "Timber Preservation at Verde Extension." *Ariz. Min. Jour.*, 1924, Jan. 15-16, pp. 5-6. (Presented before American Mining Congress, Sacramento meeting.)

[2]Actual cost, according to figures by the management of United Verde, Jerome, Ariz. (*Trans.* A. I. M. E., Vol. 66, 1922, p. 127) for sawed Oregon pine laid down at the mine ranged from $36.40 to $45.75 per 1,000 board feet in 1918 and 1919.

A Striking Example of Suspended Wall-rock Inclusions in a Vein

Vein in Crescent property near Trout Lake, Cobalt district, Canada, showing angular fragments of wall rock (diabase) "suspended" in the gangue material of the vein—indicating that vein crystallized from an ore magma of sufficient consistency to hold these fragments suspended. Photograph sent in by Kirby Thomas.



Models of Primitive Chinese Mines

AT THE recent British Empire Exhibition near London, England, a series of exhibits showing the primitive mining methods of the Chinese which are still in actual practice had a great interest for thousands of visitors.

The photograph shown below gives a very good idea of the form of mining known as gravel pump mining as carried out by the Chinese. The ground is softened by water brought in over the top of the mine. It is then led with the broken ground to the sump of the gravel pump (usually worked by the portable boiler as shown), which lifts the gravel and water up to the sluice boxes, where the tin ore is caught. The model and the engine and pump are exact copies to scale.

The photograph above shows in detail mining by the open-cut method. Barren overburden is first removed, thereby exposing the tin ore bearing gravel, which is raised and the tin ore extracted by washing. The water from the workings is carried to the higher level by the ingenious Chinese endless wooden chain pump, driven by a form of treadmill worked by coolies. The lowest part of the mine is drained by a whip pump. The two methods of carrying away the overburden by baskets and by wheelbarrows are shown. The housing details are very typical.

Petroleum in North Saghalien

Results of Geologic Investigations Made Up to the Present

By Hironao Nishihara
Consulting Mining Engineer, Dairen, Manchuria

THE signing of the new Russo-Japanese treaty on Jan. 20 cast light upon the year-long problem of readjusting the non-miscible relations between Japan and Soviet Russia. Among many things that attract immediate attention are the natural resources of North Saghalien, especially petroleum, on which our interest centers. It may not be futile to present here a brief sketch of the nature and extent of the occurrence of this commercially important natural product.

It is rather strange to note that the country north of the fiftieth parallel is favored by nature, rather than the southern half. The coal in the north is much better in grade and greater in quantity than that in the south; likewise the indications of petroleum are much stronger and by far more abundant in the north than in the south.

The first record of the discovery of an oil seepage in Saghalien dates back to 1880. Remote from the outside world, inaccessible and lacking transportation facilities, and in the midst of unfavorable climatic conditions that prevail throughout the year, this part of the island was left untouched until 1890, when the first geological investigation worth mentioning was undertaken by a Russian called Batzsevitch in the district lying between Nogulik on the south and Oha and Ehabi on the north. His report undoubtedly excited many adventurers, and in 1903 the same district was covered by Normanbotta, followed by Trichinsky in 1906. Whether it was due to natural obstruction or to their lack of geological insight, neither of them seems to have succeeded in obtaining sufficient data to make any suggestion as to the presence of geological structures such as are generally regarded as favorable to the accumulation of petroleum. A rather detailed and comparatively thorough survey was conducted under the able geologist Von Ahnert in 1907 and again under Polevoi in 1908, resulting in the collection of some trustworthy data on a small area of the oil-bearing district.

Two or three shallow trial borings put down by Sotoff in 1888 were not encouraging. In 1890 F. Kleye organized the China Oil Co. with a paid-up capital of 630,000 taels and sank some test wells in the neighborhood of Nutovo and Boatasin. He also gave up before he might have struck oil in depth, and his failure marked the last effort to this end in Saghalien. Derricks, machinery, and buildings were left to nature. This ended the first era of the history of the search for petroleum in this region. Some years ago a new company representing several large mining companies in Tokyo was organized under the name of Hokushin-Kai, or the Pole-Star Association, and extensive and intensive exploration work has been carried on. The result of this investigation is spoken of as promising, although reports have not been made public.

Topographically, North Saghalien is different from the south. The entire eastern coast north of the fiftieth parallel is hemmed with sandy terraced beaches 3,000 or 4,000 ft. wide and about 60 ft. high. A few inclosed bodies of water or inlets are kept open by the tides and by the water descending from the lands. Most of the inland lakes were probably once bays, but have now been completely shut off from the sea. The main hill range rises to an average height of 300 ft. behind this chain of swamps and lakes and trends north and south parallel with the coast. The hills are covered with a dense forest of larch trees, and the marshy plain or river bed is thickly covered with mosses and forms tundra, the worst spot for a geologist.

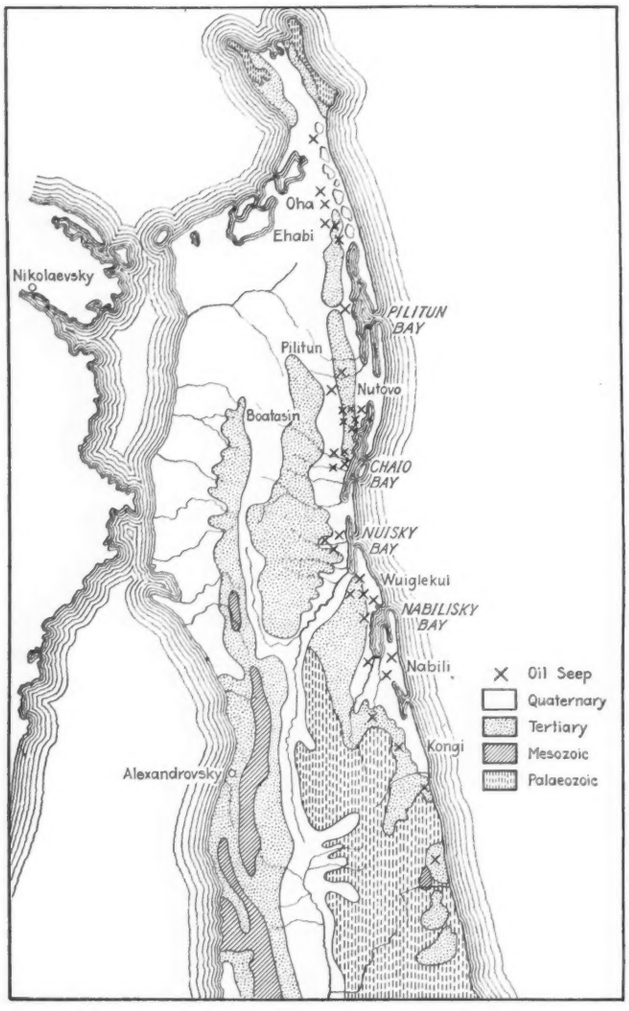
Along the east coast of North Saghalien, June, July and August are said to be the best months in the year for navigation. Although there are many bays and inlets, none is deep enough for anchorage but Chai Bay, which has communication with the outer sea through a narrow strait, called Kleye, and steamers of 15 ft. draft can drop anchor, and at high tide large steamers up to 20 ft. draft may enter. Communication and transportation facilities are as bad as imaginable. There is a single trail between Chaio and Boatasin constructed by the China Oil Co. for the transportation of its drilling machinery. The natives would rather take advantage of rivers and lakes and travel in canoes during warm seasons, and during the winter, which lasts seven or eight months, they resort to the sledges. Cold weather prevails throughout the year, and even in the height of summer the temperature seldom rises to 80 deg. F. The daily variation is as much as 30 deg.

The rocks exposed in North Saghalien are of Paleozoic metamorphics, Mesozoic, Tertiary, and Quaternary sedimentaries and igneous intrusive porphyrite. The Paleozoic rocks occupy the southeastern section and the northern extremity. The Mesozoic rocks are mostly found along the western coast. The rocks of the Tertiary system, which are considered to be the only petroleum-bearing formations at present, make up the main hills and ranges that trend north and south. The presence of porphyrite is noted, but is of little importance. Because of the blanket of tundra, which at places is 10 ft. thick, it is difficult to study the nature of the rocks and the stratigraphic relations.

The compilation of data collected from various parts of the field may be sufficient to represent the Tertiary system in North Saghalien as follows:

Upper series	Loose sand. Conglomerate. Sandy shale. Oha oil seep. Conglomeratic sandstone. Sandy shale. Pilitun and Nogulik oil seep. Sandstone and shale. Ehabi oil seep.
Middle series	Shale. Sandstone and shale (some lignite). Middle sandstone. Orukuni oil seep.
Lower series	Argillaceous sandstone and shale. Slate. Lower sandstone (thin coal seam). Conglomerate.

The general strike of the Tertiary rocks is nearly north and south and the dip is either east or west at



Geologic map of North Saghalien, showing the location of recognized oil seeps. In appearance these are said to be quite striking

angles varying from 20 to 80 deg. Several anticlinal folds, which are considered to be favorable for the accumulation of petroleum, have been located at Oha, where the axis, pitching north, is about two miles long. The Ehabi anticline trends nearly parallel with the coast line from Ehabi Lake to west of Ajap Lake. Here the dip angles of the rocks are between 30 and 50 deg. In the Nutovo region near Chaio Bay is reported to be the largest known anticline running parallel with the coast line from Pilitun River to Woav River. Another anticline is indicated at the Kongi River, where at a point up the stream the dip is west at 45 deg. At another point down the stream it is east at 60 deg.

As to the age of the oil-bearing Tertiary rocks, both P. Polevoi[1] and N. Tikonovitch[2] suggested in their reports that it was Miocene and Pleiocene.

Oil Seeps Striking in Size and Extent

The oil seeps at Oha, Ehabi, Nutovo, Boatasin, and Nogulik are all good and distinct. In appearance they are most striking because of their size and extent. At certain places large areas of the swamp and basin are covered with "kir," a dark-brown mass made up of bituminous matter, which is marked on the surface with numerous sun cracks. The largest known "kir" near Oha has been reported by witnesses to be 250,000 sq.ft. in area.

Analyses of crude oil from the Oha and Nutovo districts are as follows:

Oha district. Baumé 20.5 deg. distillate.

	Per Cent
0—200 deg. F.	5.7
200—250 deg. F.	8.3
250—300 deg. F.	7.7
300 and over	78.3

Nutovo district. Baumé 25.0 deg. distillate.

	Per Cent
0—250 deg. F.	3.0
250—300 deg. F.	25.0
300 and over	72.0

All the former investigators reported the existence of monoclines, but recent investigation seems to prove the existence of many strong anticlines. Furthermore, the dip angles in most cases are about 30 deg., which is considered the most favorable angle for the accumulation of petroleum. From our deduced knowledge of the Tertiary in North Saghalien it is certain that the seeps are located on or near the anticlinal axis along its strike line.

During the Japanese military occupation of North Saghalien exploration work has been persistently carried on, and at present it is reported that there are thirty producing wells with an average total output of 250 bbl. a day.

Estimating Precious Metals in Mercury Quantitatively

Recent reports of making gold from quicksilver have brought out the fact that gold often exists as an impurity in quicksilver, so its freedom from the precious metal must first be assured. A method for the quantitative detection of minute amounts of the precious metals in mercury was recently published by A. Miethe and H. Stammreich in *Zeitschrift für anorganische chemie* and abstracted in a recent issue of *Chemistry and Industry:*

One thousand grams of mercury are distilled under ordinary pressure until only 20 g. remain. The residue is transferred to a small distillation apparatus and distilled slowly under reduced pressure until all but about 1 g. has passed over; this is then dissolved in pure concentrated nitric acid at the ordinary temperature, whereby the gold is left as a very fine network of porous gold crystallites in a spherical form, the diameter of the sphere being 2.24 times that of the same amount of gold after melting, so that by measuring this diameter the amount of gold present can be calculated. Alternatively the sponge is fused with 0.1 g. of borax and the diameter of the resulting sphere of gold measured under the microscope. Silver is recovered from the nitric acid solution by neutralization with ammonia, precipitation of the mercury and silver together by boiling with hydrazine sulphate, and careful distillation of the mercury. The silver sponge is treated similarly to the gold, but the bead should be weighed directly if its diameter exceeds that corresponding to a weight of 0.02 mg.

[1]P. Polevoi: "Das Erdoelgebiet des Nord-oestlichen Sachalens," 1909.

[2]N. Tikonovitch: "The Schmidt Peninsula," 1914.

Useful Operating Ideas

Recovering Stuck Diamond Drill Bits

By Roy H. Poston

Stuck diamond drill bits may result from several causes. Anything dropped into the hole when the rods are partly removed makes the recovery of the rest of the rods difficult, although the bit may be resting loosely on the bottom of the hole. Figs. 1, 2, 3 and 4 show graphically some of the conditions that cause stuck bits and indicate respectively rocks and dirt on top of rods; a broken or twisted rod; failure of pump or excessive mud or sand; a natural opening. When the bit becomes fastened, the pump is operated, if possible, continuously until the method of recovery is decided upon, as this will usually prevent further accumulation of débris in the hole.

Reaming or enlarging the hole, although usually the last resort to recover a stuck bit, is first mentioned to point out the reasons why it is the last and most expensive method of recovery if the hole is deep, 100 ft. or more. Reaming a hole means to redrill it from the surface to a point a little past where the bit rests, with a second bit, large enough to go over the first. After this point has been reached the first bit and core barrel are usually recovered in the core barrel of the remaining bit, as would be done with an ordinary run of cores, or by means of a spear or female tap. The depth of the bit as well as the depth of the top rod, if they are disconnected in the hole, is first noted and recorded.

Fig. 5 shows a guide used in conjunction with the reaming bit to keep the reamed hole in line with the original hole. The guide is slightly smaller in diameter than the first hole and is made to precede the reamer bit as shown in the figure. In drilling operations the direction of rotation of the rods is clockwise, and therefore the connections between rods are by right-hand threads and the rods are known as right-hand rods. When the bit becomes stuck, and where for any reason it is desirable to remove the rods in the hole, they are "broken" at any point where they will separate by unscrewing, which usually results in leaving a part of the rods in the hole. Rods that have left-hand threaded connections are then substituted for the removed portion of right-handed rods, and a new connection is made in the hole by means of a female tap, a male tap, or a spear. See Figs. 6, 7 and 8. Whichever one is selected is screwed upon the end of the leading left-handed rods. The direction of rotation of the rods is reversed. The rods will "break" or unscrew at a new point further down in the hole, and after each new connection allow another section to be recovered. It is obvious that if during ordinary operation the rods become unscrewed it is possible to reconnect them by careful rotation of the top sections by hand wrenches before withdrawing the top portion of the rods.

If conditions are assumed to be as shown in Fig. 1, a blank or used bit, without diamonds, is placed on right-hand rods and an effort made to grind up the substance A, if it is a rock or piece of clay, and by constantly running the pump to wash the fragments out of the top of the hole. Success or failure can be determined by noting the depth the blank bit has reached and by the color of the water rising from the hole, provided the hole is not a "lost water" hole. When all rock or other débris has been removed from the rods in the hole it is an excellent plan to lower a piece of beeswax on the end of the drill rods and take an impression of the top of the lost rods. This will, of course, determine the condition of the top rod.

To determine the angular position of the top of the rod in the hole, a piece of chalk or keel is held firmly in one place at the top of the hole as the rods on which the beeswax is fastened are lowered therein, the end of the chalk pressing against the descending rods and making a continuous line for their entire length.

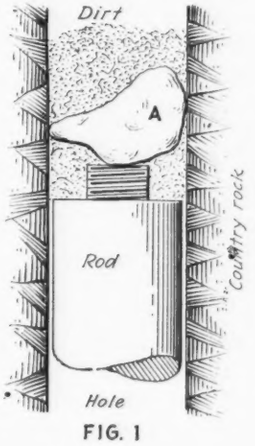


FIG. 1

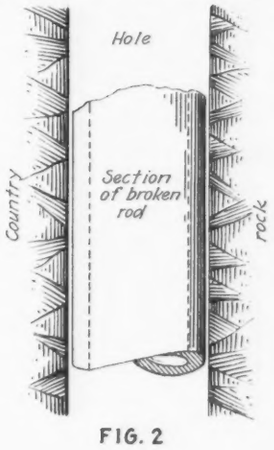


FIG. 2

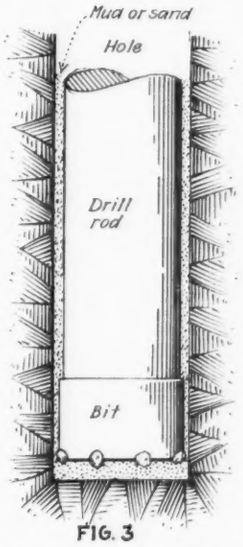


FIG. 3

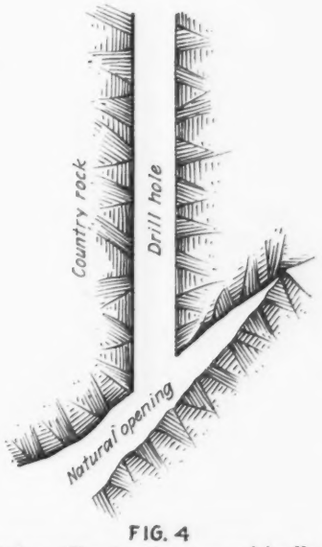
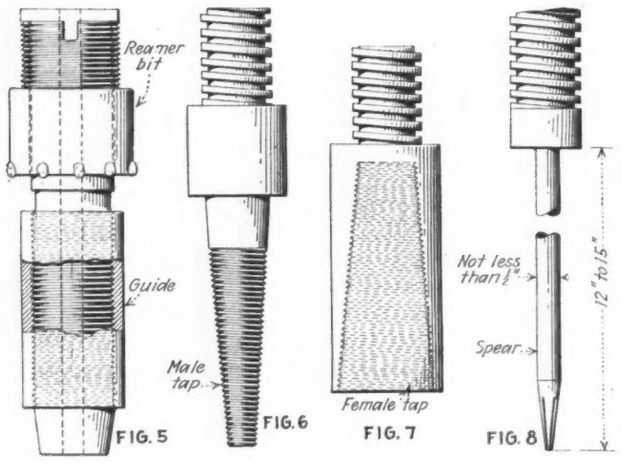


FIG. 4

Figs. 1, 2, 3, and 4—Sketches illustrating graphically some of the conditions that may cause stuck diamond drill bits

Fig. 1—Rocks and dirt on top of rod. Fig. 2—Broken or twisted rod. Fig. 3—Failure of pump, or excessive mud or sand. Fig. 4—Bit runs into cavity in formation that is being drilled.



Tools used in fishing for stuck bits

Fig. 5—Guide used in conjunction with reamer bit to keep reamed hole in line with original hole. Fig. 6—Male tap. Fig. 7—Female tap. Fig. 8—Spear.

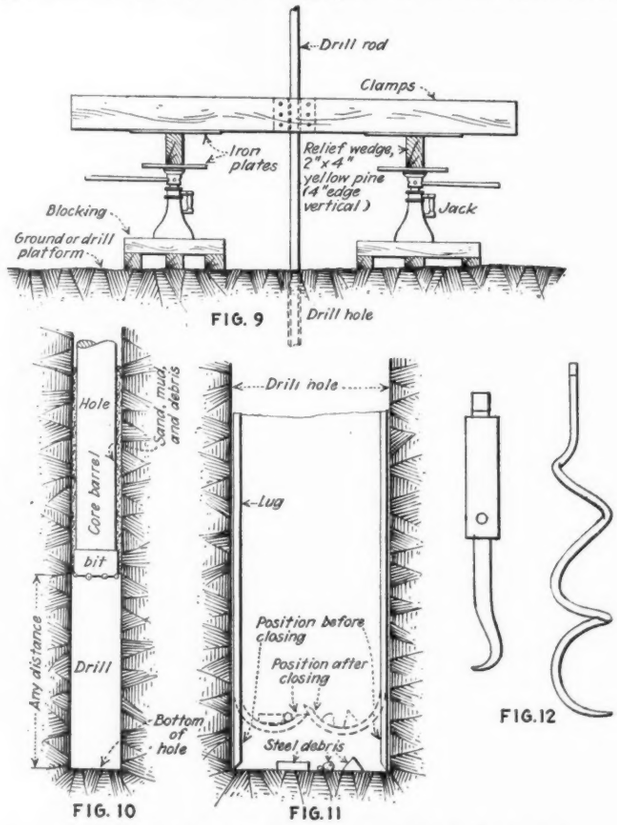
If the object is iron or steel and is not of too great weight, or is not wedged in the hole, it may sometimes be recovered by fastening a piece of beeswax on the end of the rods and lowering them down and picking up the iron. Care must be taken to jar or vibrate the rods as little as possible as they are being removed. Substances of this nature may also be removed by placing a strong electro-magnet on the bottom rod. Power for the magnet may be had from batteries or from an automobile magneto. If the substance is composed of wood or some soft non-magnetic metal, as copper or lead, an effort should be made to go over or around it with a blank bit and to wedge it by pressure into the bit sufficiently to lift it up to the surface.

After all foreign substances have been removed from the top portion of the rod, the left-handed rods are brought into use and an effort is made to make a connection with taps or a spear, as explained before. If conditions are as shown in Fig. 2, and the end of the rod is known to be open, the use of a spear, Fig. 8, in conjunction with left-handed rods is used to make a connection with the broken section. After a connection is established the rods in the hole will usually unscrew at a lower point and thus afford simpler conditions for the removal of the remainder of the rods. However, if the top end of the broken rod be closed up, a more difficult problem must be overcome. It is necessary to employ a female tap instead of a spear, and an effort is made to get over the end of the rod and to effect a connection by running the threads far enough to unscrew and lift a section or two of rods. It may be even necessary to ream the hole to this point or a little below it and then by the use of a larger female tap to get hold of the broken rod. The threads for the male tap, female tap, and spear are made left handed for use with left-handed rods and of case-hardened steel.

Where a condition is known to exist as indicated in Fig. 11, pieces of steel, iron, or even diamonds that have been pulled out of the bit on the bottom of the hole may sometimes be recovered by placing a lug on the bottom of the rods, lowering them in the hole, and then operating them at high speed and with great pressure, without water. This causes the lower end of the lug to become heated and to slowly close up, picking up the objects as it does so. Before starting this expedient the rods are marked at the top of the hole. Closure is indicated by the downward drop of the rods. Occasionally when lowering the rods in the hole they will hang up at some point off the bottom, caused by a piece of loose rock in the side of the hole. See Fig. 10. In a case of this kind, once past the obstruction, usually the rods will continue in their downward course. To remove the obstruction, break the rods somewhere above the top of the hole and put an old lug or coupling over the exposed threads and endeavor to break through the obstruction by hammering the top of the lug or coupling. If this fails drill out the obstruction.

Probably the most difficult thing is to recover a bit or rod when it has fallen into an opening or channel as in Fig. 4, since the rod is out of line and its position a matter of conjecture. Generally when a section of rod inclines away from the vertical more than 10 deg. recovery is almost impossible. The special home-made grappling tool shown in Fig. 12 was on one occasion successfully employed at a Missouri mine to get a rod back into a position where a coupling could be made by means of a female tap.

Hydraulic jacks as well as the ordinary screw jacks are sometimes successfully used to loosen a bit that has become tight under conditions shown in Fig. 3. Clamps with projecting arms are fastened to the drill rods at the surface and the jacks placed under these arms and operated in the usual way. This method is not recommended, however, because if the bit is tightly stuck the resulting strain may pull the rods in two at some weak point or pull the diamonds out from their setting in the bit, and then the chance for their recovery is slight. Only an experienced operator should attempt the use of jacks for this purpose. Jacks should be raised uniformly on both sides. The use of the relief wedge as shown in Fig. 9 is recommended. When these wedges yield under the strain enough pressure has been exerted.



Incidents in recovering stuck bits. See text

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

American Association of Engineers Defended

THE EDITOR:

Sir—I note in your issue of Feb. 14 that the San Francisco Section of the American Institute of Mining and Metallurgical Engineers disapproves of the proposed license law known as Assembly Bill No. 333, and in doing so takes a fling at that "well-organized minority of subordinates" and tyros who have fathered this bill and others like it in other states. In plain English the American Association of Engineers.

It is indeed time that some one took a hand in curbing the activities of an organization that has the temerity to hold that an engineer's duty is civic as well as technical. Not to mention the fact that some of the chapters actually put on their letterheads these words: "Objects of A.A.E.: To raise the standard of ethics of the engineering profession and promote the economic and social welfare of engineers." (That came from San Diego.) And, shades of the old *M. & S. P.*, they've stolen T. A.'s thunder and encourage members to contribute articles to the technical press for the valuable training received, even if they are not good enough to print.

But, worst of all, they are "catching them young" by invading the colleges and universities, in many of which they have a 100 per cent membership. Just think what this means—the entire present enrollment in the schools of engineering of many of our leading universities doomed to mediocrity! The University of Arizona has even fallen so low as to have one of these, G. M. Butler to be exact, as Dean of the College of Mines and Engineering. He must be particularly obnoxious, as he is the president of the National Council of State Boards of Engineering Examiners, and even delivered an address in Washington, D. C., on Nov. 10, 1924, the subject of which was "What Is the Matter With Engineering?" Of course, to quote the San Francisco Section, "The best men of the profession would be required, and these would not serve; the best men never do serve in such positions." Which of course effectually squelches Dean Butler.

Now, as to the proposed licensing law. The real drawback to me personally is of course the fee that will be required, but to any but a "subordinate" or a "tyro," who is "hoping for an increase in pay," money should be no object.

As to a chemical engineer designing the Golden Gate Bridge, according to Section 10, Paragraph (b), "Engineers holding certificates of registration in one branch of professional engineering as above defined may be issued certificates in other branches without additional fees *upon having passed an examination conducted by the board in such other branches.*"

The laws governing the practice of medicine and surgery, or law, cannot of course eliminate the incompetent, but they at least give some protection against the quack and shyster, and aid in giving their respective professions a definite standing.

In conclusion, let us have all the candid discussion on this and any other subject that it is possible to get, but as we all live more or less in tin houses, let's be careful with can openers. EDWARD T. TELFORD.

Soulsbyville, Calif.

The Gordon Gas-House Liquor Process

THE EDITOR:

Sir—A mild criticism of the reference to the Gas-house Liquor (Gordon) process in the article by Arthur B. Parsons in *Mining Journal-Press* of Jan. 10, entitled, "Progress in Hydrometallurgy of Lead-Zinc Ores," is due, wherein it is said that the "feature of the process" is the use of byproduct gas-house liquor as a cheap source of ammonia.

The facts are that gas-house liquor is the actual solvent menstruum applicable to calcines or otherwise oxidized complex products, rather than the ammonia contained in the liquor, and on this fact our patent was issued. Zinc oxide is not soluble in ammonia. To be sure, ammonia is contained in gas-house liquor, but also there are contained many other elements and compounds which together form a very active solvent of zinc as well as of other metals of the acid-soluble group. These components of gas-house liquor, being volatile, are of course regenerated and recovered together as the metal salts are precipitated, excepting the carbon dioxide contained in the recovered salt. However, even this latter is returned to use through the calcination of this carbonate precipitate.

It is inferred also that this recovery method is limited to complex ores of siliceous gangue. Ferrites are no more troublesome herein than in normal-strength acid solution, and, having the advantage of a broad scope of sulphate in the calcines, the formation of ferrites is consequently avoidable in the roast. The grade of zinc ore, concentrate, or middlings treatable is limited only by commercialism and the zinc contained in the sludges in conforming to lead blast furnace treatment economies, as the sludge must be thus treated for the recovery of the lead and precious metals contained.

The difficulty of roasting fine flotation concentrates properly without extravagant mechanical losses suggests reasonable granular separation as an economy to the mine in preparing for the required calcination; hence my mention of middlings, however, therein meaning to include all of the table product between the clean lead crystals on the high-gravity side and the unattached and barren gangue. E. W. KEITH.

Denver, Colo.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

DEVELOPMENT of lead-silver properties in Central Idaho is being stimulated by the operations of the Ford Motor Co. at the Red Bird and the General Motors Co. at the Livingston mine.

Buying and selling of mines and leases feature activity in the Joplin-Miami zinc-lead district.

The Michigan State Geologist believes that the Alpena gold "rush" is based on finding pyrite in the limestone.

Ahmeek, producing nearly 3,000,000 lb. of copper a month, is the principal source of Calumet & Hecla's current output.

The Shattuck Arizona Copper Co. has restarted the Denn concentrator at Bisbee, Ariz., on galena ore.

Payment of its first dividend is announced by the Gladstone Mountain Mining Co., mining lead ore in Washington.

Operations at the Aspen Smelting Co. may mark the revival of the famous old Colorado silver camp.

Deep exploration in the Tonopah district is being conducted by four or five well-financed companies.

Perpetuation of the Senate Gold-Silver Commission will depend on Senator Oddie's success during the extra session of Congress.

Fire in the Burma Mines Co.'s property at Bawdwin has seriously depreciated the value of the shares on the London exchange.

Trading in Mines and Leases Features Joplin-Miami

New Companies Formed — Greatest Activity Since 1918—Isherwood Mill Started

Much activity is still to be noted in the Joplin-Miami district. Several new mines are being opened, a number of new companies that promise to become important have been organized, and several sales of mines and lease purchases await consummation. There is more activity than since 1918.

D. F. Haley, until recently manager for the American Metal Co., in this field, and who resigned when the company decided to cease operations here, has organized the American Prospecting & Mining Co., composed largely of Kansas City and eastern capitalists. The company plans to do extensive development work upon a number of leases which it has obtained.

F. W. Evans, of Picher, Okla., who took over the Empire mine some time ago, and the Leonora more recently, has taken an option on the S. S. & G. property in the South Picher field, with additional acreage to bring the total to 200.

C. F. Dike, of Joplin, and John P. Heffernan, of Outremont, Canada, have taken over the Meteor mine and mill near Hockerville, Okla., and will rebuild the mill and place it in operation.

The Kansas Explorations Co. has completed and placed in operation the Isherwood mill, at Smithfield, northwest of Joplin.

The U. S. Steel Corporation, which has been drilling leases in the Peoria, Okla., field, is reported to have taken an option on a large acreage southwest of Carthage, Mo. Several drill rigs already have been moved to the tract.

The Liza Jane Mining Co. has about completed moving the Sinden mill from Oklahoma to its lease west of Baxter Springs, Kan.

The Missouri Royalty Co., the principals of which are A. E. Bendelari and George Potter, vice-presidents of the Eagle-Picher Lead Co., has recently purchased 472 acres of land in Missouri, about 8 miles northwest of Joplin, for mining purposes. A. E. Mattes and associates have one well-developed mine on the tract, and it is possible the company will sublease other parts of the land, or lease all the remainder of it to one developing company, or decide to itself develop the property.

Practically all the acreage in this territory had been leased during the last year.

Lower Smelting Charges on Customs Ore at Trail

The Consolidated Mining & Smelting Co. of Canada has revised its lead schedule, giving shippers an advantage of about $1.25 per ton, compared with the old schedule, which expired on Feb. 28. In announcing the revision the company has stated that both the lead and the zinc schedule will be given a further downward revision when the extensions now being made at the smelter have been put into operation. It is expected that the extensions will be completed about midsummer.

State Geologist Cannot "See" Alpena, Michigan, Gold Field

Does Not Doubt Integrity of Assayers —Intimates Salting—Pyrite Apparently Cause of Hunt

The Michigan Geological Survey has been unable thus far to find any trace, much less appreciable quantities, of either gold or silver in any of the samples taken by its representatives or submitted to them from the so-called Alpena gold field; nor has it been able to find any geological conditions favorable to the occurrence of these metals or ores in important quantities, according to R. A. Smith, state geologist.

As to the validity of many of the assays showing appreciable to large gold and silver values, there is no question in the minds of the officials. "Some of the assayers are men of unquestioned competency and integrity. We are not presuming to say how or when the gold got into the samples. So far as we can discover only one assayer took his own samples, and he apparently did not concern himself seriously with precautions necessary to assure that the sample assayed was in exactly the same condition in which it came from the bed rock," says Mr. Smith, in discussing the situation.

The "pay streak," as pointed out by drillers, is a hard fossiliferous limestone layer below 220 ft. Some of the limestone contains pyrite, or "fool's gold." Apparently it is the pyrite, or "fool's gold," which is abundant in both the limestone and shale, that has led to the present explorations.

Plymouth Mine, Shut Down, in Hands of Receiver

The Plymouth mine, at Plymouth, Calif., operated by the Plymouth Consolidated Gold Mines, Ltd., was shut down on Feb. 28, 1925. Charles Culbert, president of the Bank of Amador County, foreclosed certain loans made to the mining company, and the property is now in the hands of a receiver. A few men have been retained, and the mine pumps are being operated to keep the shaft free from water. A little more than a year ago, the Plymouth floated a new stock issue for the purpose of financing additional shaft sinking. The main shaft was sunk to a depth of 3,920 ft., measured vertically.

Financial difficulties are the result of efforts to extend development to a sufficient depth to enable orebodies opened up by a winze to be mined from shaft levels and to discover new orebodies.

Ahmeek Now Most Productive Copper Mine in Michigan

Ahmeek, a unit of Calumet & Hecla Consolidated, in the Michigan copper district, has increased tonnage of late. It now is hoisting 3,700 tons of rock daily from Nos. 2 and 3-4 shafts. This, with an approximate yield of 30 lb. per ton, places Ahmeek on the basis of 2,900,000 lb. of refined copper per month. It is the largest producer in the Lake district. Ahmeek has speeded up mining through the adoption of a new type of rapid drill, 135 of which now are in use in the property. The drill strikes 2,400 blows per minute, compared with 1,800 by the old type of drill. The new drills may come into general use in the Calumet properties. Mohawk also is testing the same type of drill.

Gladstone Mountain, Lead Producer, Becomes Dividend Payer

The Gladstone Mountain Mining Co., operating a lead mine 15 miles East of Boundary, Stevens County, Wash., declared its first dividend on Feb. 26. It amounted to ½c. per share on an issue of 1,321,890 shares. The dividend is payable March 10 to stockholders of record March 5. The company has a surplus of $112,425 in the treasury.

The cash surplus together with the physical conditions of the property warrant the distribution of dividends monthly according to Thaddeus Lane, president of the company.

The company mines lead ore from a succession of chimneys that have been developed during the past two years. The ore, as carbonate in the upper zone with galena appearing at depth, is shipped crude. There is a 15-mile haul to the railroad, whence it is transported to the Bunker Hill smelter at Bradley, Idaho.

Another property in the vicinity has entered the shipping list. It is the Blue Ridge mine, near Alladin, Wash., which property recently shipped forty tons of silver-lead-zinc ore to Great Falls, Mont. The company plans to install extensive machinery this summer.

Ford Motor and General Motors Companies Help Revive Idaho Mining

Red Bird Equipped—New Concentrator at Livingston Mines—Motor Truck Important Factor in Solving Haulage Problem

Special Correspondence from Mackay, Idaho

LEASING by the Ford Motor Co. of the Red Bird mine, one-time big producer of silver-lead ore, in Custer County, Idaho, has helped materially to stimulate activity in mining operations in the central part of that state.

The mine was first a "pay dirt" claim, struck by Pat O'Connor, an old stage driver, in 1879. Four years later O'Connor sold his claim to the Clayton company, of Chicago and Omaha, for a consideration of $15,000. The new owners erected a smelter on the property, and for more than twenty years the mine yielded millions in high-grade ore.

When the lead and silver market touched bottom in the latter 90's, the property fell into the hands of Lawrence Green, who in turn operated the mine for several years. He finally sold it to Robert M. Bell, who succeeded in interesting the Ford company after developing on a small scale for about two years.

Since the leasing of the mine activity heretofore unheard of has stirred in the quiet settlement of the Mackay district. Equipment of various kinds for transportation and mining has been assembled. Fordsons rigged with "trial-mobiles," sawmills, steam shovels, hoists, graders, and rotary snowplows have been provided. Workers have transported and installed at the mine a power plant, air drills, diamond drills, a compressor, portable houses, offices, warehouses, and all equipment necessary for development on a large scale. The nearest railroad station is Mackay, 60 miles from the mine.

Within a radius of 150 miles, in Butte, Custer and Lemhi counties, are several important mines, including the Livingston, the Gilmore, the Ramshorn, and the old Nicholia property. The Ramshorn property, owned by William Randolph Hearst, and the Salisbury interests, of Salt Lake City, until fifteen years ago were steady producers of silver and lead, but owing to poor transportation facilities operations have been greatly restricted. The mill and other equipment is now being put into condition, and in the early spring the mill wheels will once more turn.

The Livingston mines, situated on the East fork of the Salmon River, in Custer County, are now controlled by the General Motors Co., of New York. Since the early fall of last year, work has been going on consistently, preliminary to extensive development. More than $1,500,000 has been expended in constructing a three-mile tramway, a hydro-electric power plant, and a new concentrating mill, which is about to go into operation.

Another mine that is being reopened after several years of inactivity is the Whynot, a gold property near Estes Mountain, on Jordan Creek, a tributary of the Salmon. It is owned by W. H. Walker, a capitalist with numerous interests in this vicinity. It was first located in 1879. Poor transportation caused operations to be suspended about ten years ago, but the development of the motor truck has lessened this problem, and the property is being reopened this spring. The mill will be started.

Harry S. Knight, of Salt Lake, an authority on facts and figures pertaining to the output and development of the central Idaho group, gives in a recent report an accurate estimate of what is being accomplished by the various mines of the district.

The Wilbert mine, in Butte County, according to Mr. Knight, is producing about 150 tons of concentrates per month. The Wilbert has produced to date 30,000 tons of first-class ore, averaging 50 per cent lead and 8 oz. silver per ton, and 22,000 tons of concentrates averaged 54 per cent lead and 9 oz. in silver per ton. Production in 1924 ran low, owing to the fact that the new mill which was built to replace the one burned in 1919 was not completed until October.

The Gilmore district, in the Birch Creek Canyon, shows a production of about $6,500,000, and the tonnage is about as follows: Pittsburg-Idaho, 160,000 tons; the Latest Out, 90,000 tons; the Gilmore-Allie, about 20,000 tons; miscellaneous, including the Spring Mountain district, Worthing, and Scott mines, on Birch Creek, the Lemhi-Union, the Mountain Boy and other outside properties, a total of 5,000 tons. The ore has been mostly smelting ore, carrying about 25 to 30 per cent lead and 10 to 15 oz. silver per ton, and 50c. to $1 gold, with the exception of about 15,000 tons of gold-iron ore from the Gilmore-Allie group, which contained 50 per cent iron and averaged $15 in gold per ton. During 1924 the Latest Out shipped an average of about twenty cars of ore per month; the Pittsburg-Idaho has shipped about three cars per month, and the Gilmore-Allie about one car per month.

The Leadore district, according to Mr. Knight, has probably shipped 100 cars of silver-lead altogether, principally from the old Leadville, the Baby Joe, and the Kimmel mines. This group showed a production of only a few cars in 1924. At Salmon City, the Harmony, the Pope-Shenon, and Tormey mines have been active, and during the last year have shipped about twenty-five cars of concentrates carrying from 20 to 25 per cent copper.

Plans are also being made for reopening the old Nicholia property in the mountainous section of the Birch Creek Canyon, which twenty years ago produced one-third of the lead of the entire state. The total output of the Nicholia aggregates $6,000,000 in high-grade ore. Production was halted about twenty years ago, when the lead mar-

Miner Loses Damage Suit Based on Contracting Tuberculosis

THE $50,000 damage suit brought by H. E. Niemy against the Calumet & Arizona Mining Co. has been decided by the jury in favor of the company at Tombstone, Ariz. Niemy alleged that he had contracted miner's consumption and tuberculosis while working in the mines at Bisbee. The case has attracted state-wide attention, particularly in the mining camp, as it is the first case tried in the state where miner's consumption and occupational tuberculosis were factors.

Testimony was given by Dr. Flynn, of Prescott; Dr. Watson, of Tucson, and others to the effect that Niemy was not affected with miner's consumption, and that the mines at Bisbee are not dangerous in so far as lung diseases are concerned. Other evidence showed that Niemy had been given a safe place to work in and had been furnished with proper appliances and tools.

ket slumped to a point where it would no longer justify smelting the ore. Poor transportation was another cause for the closing down of the Nicholia, as it was necessary to transport coal and coke for the smelter for a distance of 80 miles. The property has changed hands a number of times. It was controlled by an English syndicate for several years, but is now the property of Ralph Nichols, of the Gilmore district.

Significant of the development of the central Idaho district is the movement now under way to construct a highway from the center of the district across the desert on the west side of Snake River to Idaho Falls, which is conceded to be the gateway to the mining section.

Hypotheek Has Rich Ore in 100-Ft. Shoot

The Hypotheek mine, situated in the extreme west end of the Coeur d'Alene district, Idaho, was recently the scene of a remarkable ore discovery. The strike was made by drifting west from the shaft at a depth of 700 ft. The ore is both carbonate and lead sulphide, some of the latter running as high as 80 per cent lead. The ore covers the face of the drift and is probably much wider, and has now been proved for 100 ft. with no evidence of reaching the end of the shoot.

The Hypotheek has had an interesting career. Many years ago similar ore was discovered east of the present strike, and in due time the property was equipped for production, including a mill of 125 tons' capacity. At a depth of 1,000 ft. the ore disappeared, and although the shaft was sunk to the 1,100 level, no ore was found. Since that time efforts have been directed to finding another oreshoot west of the shaft, which have finally resulted in the discovery here described.

Shattuck Arizona Restarts Denn Mill on Lead Ore

Officials of the Shattuck Arizona Copper Co. announce that the lead concentrator at the Denn mine will be restarted soon. The concentrator has been shut down since December, 1920. The ore to be treated comes from the Shattuck mine and has been going to the El Paso smelter since the mine resumed operations in February, 1923. The resumption at the mill is due to the high price of lead and is the most important increase in mining activity in Bisbee in some time. Reopening of the Denn mine, which has been idle since August, 1921, is not at present under consideration.

Some promising ore, said to contain gold and silver values to the amount of $30 a ton, has been discovered on the 300 level of the Shattuck.

Two Verdes Defendants in Smelter Smoke Suit

The second smoke-damage suit filed in Arizona and the first of such actions to be referred to a jury in a United States court will be tried in March.

The plaintiffs, W. A. Jordan & Sons, ranchers of the Verde Valley, are asking $31,000 for alleged damage to crops caused by the smelters at Clarkdale and Clemenceau. Unlike the previous case, tried three years ago, the present issue is said to be fortified with data obtained over a period of activity and inactivity at the smelter.

The plaintiff, it is stated, was formerly superintendent of ranches for the United Verde Copper Co.

Rain Helps Placer Mining in California

The abundant rains of the first few months of the year have turned interest from river mining in California to the usual placer operations, all of which are on a relatively small scale. In Trinity County, twenty-five small placer mines are said to be in operation, with sufficient water for several months' working. In contrast with this, a year ago, due to lack of rain, only two placer mines were in operation in Trinity County.

Simon Silver-Lead Mines Co. Will Restart Mill

The Simon Silver Lead Mines Co.'s flotation mill has begun treating ore from the company's mine. The mill has been idle for the last eighteen months, during which time the new shaft was deepened and sufficient water developed to insure continuous operation.

The mine and mill are situated in Mineral County, Nev., about 20 miles east of Mina. J. B. Kendall has been appointed mine superintendent. Recent developments are reported as being good. Some high-grade lead ore is being shipped direct to the smelter. Lead and zinc concentrates will be shipped by auto truck to Mina, and thence by railroad to the smelter. H. Bruce Gibson is the manager for the company, and Joseph Pickering mill superintendent.

Active Season in Prospect in Marmot River District

Part of Portland Canal Region in British Columbia—Porter-Idaho Company May Build Tram

The coming season will see a good deal of development at the southern end of the Portland Canal district, in British Columbia, and particularly in the Marmot River division. The Porter-Idaho Syndicate, which has done considerable development on a property on the north branch of the Marmot River and shipped 150 tons to the Selby smelter, which brought a return of $21,500, has been taken over by the Porter-Idaho Mining Co. The new company, besides continuing development at the upper level, will drive a tunnel that is expected to cut the orebody at 300 ft. from its portal and at a depth of 350 ft. If conditions at this point are satisfactory, a tramway will be erected from the mine to the north fork of the Marmot River, a distance of about two miles, and, later, when ample ore has been developed to warrant it, a mill will be erected at this site, whence there is a wagon road to the mouth of the river, about 2½ miles below Stewart.

On the opposite side of the north branch of the Marmot, and between it and the main river, Thomas Campbell and W. R. Harner have consolidated a large number of claims, including the Montana, Patricia, Fraser, and Wire groups, and now are organizing a company to take over and develop the consolidation. The owners of the Montana and Patricia groups have been quietly developing their properties during several seasons, and have exposed some promising bodies of ore, but, up to now, no attempt has been made to ship, because, owing to the absence of a road, the cost of hauling the ore to tidewater would absorb the profits of mining. A trial shipment of ten tons was packed down from the Fraser group just before winter sent in last year, and smelter returns yielded $89 per ton in silver, gold, and lead.

Development has been carried on at the Silverton group, situated across Bear River from Stewart, through the winter, and ten tons of sorted ore, won in development, will be shipped to Tacoma in the spring. About three years ago, thirteen tons taken from this vein gave a smelter return of $175 per ton. The ore contains a considerable amount of freibergite; picked samples have assayed as high as 1,148 oz. of silver per ton.

Nickel Ore in British Columbia

What C. E. Cairns, of the Canadian Geological Survey, describes as an exceedingly promising deposit of nickel ore has been found on Emory Creek, near Hope, in the Boundary district of British Columbia. The ore is said to be similar in general character to that of the Sudbury district, but lower in nickel content. The discovery was made at an elevation of between 4,000 and 5,000 ft., and at a distance of 13 miles from the railway. It is stated that the Anaconda Copper Mining Co. has secured an option on the property, but this has not been verified.

Aspen Smelting Co. Hopes To Revive Old Colorado Camp

Operates Smuggler Mill—Cowenhoven Tunnel Properties Reopened—Smelter May Be Erected

Special Correspondence from Aspen, Colorado

Regular shipments of ore and concentrate to the Arkansas Valley smelter at Leadville, Colo., were begun by the Aspen Smelting Co. in February. The company is closely associated with the Aspen Mines Co., which has taken over a group of properties along the Cowenhoven tunnel at Aspen, Colo. The smelting company has taken a lease on the 300-ton Smuggler concentrator and a number of mines which it will work by subleasing. The concentrator has been overhauled and is being supplied with ore from the Smuggler lessees and from the Cowenhoven tunnel and the Durant tunnel properties.

Mill heads are said to average 5.5 oz. of silver and 2 per cent lead. The recovery has been 68 per cent of the silver content and 92.5 of the lead. Concentrates, as shipped, have averaged 18 oz. silver and 11.5 per cent lead. A typical settlement sheet with silver at 68½c. and lead at 10c. shows:

Analysis

Silver, oz.	14.4
Lead, per cent	12.0
Insoluble, per cent	22.1
Iron, per cent	5.0
Lime, per cent	17.1
Zinc, per cent	3.6
Sulphur, per cent	3.9

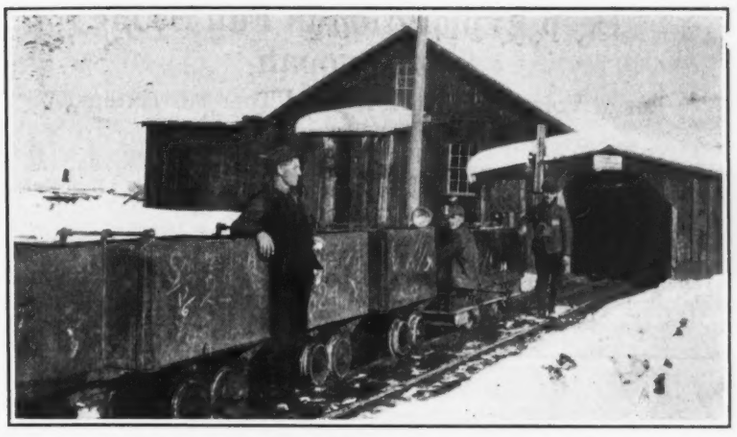
Debit

Base	$5.75
Sulphur	0.72
5 per cent silver deducted	0.49
Excess value, 20 per cent deducted ($10 free)	4.03
Lead debit (25 per cent above $9.50)	0.53
Total	$11.52

Credit

Silver	$9.86
Lead	17.85
Lime	2.57
Total	$30.28
Treatment	11.52
	$18.76
Freight	1.90
Net per ton	$16.86

The company also is shipping to Leadville, under contract, a lime ore that is averaging 49 per cent lime and containing an average of 6 oz. in silver. Also some zinc-lead ore averaging 32 per cent zinc and 14 per cent lead, with a low silver content, not exceeding 6 to 8 oz. per ton, is going to a paint-pigment concern at Coffeyville, Kan.



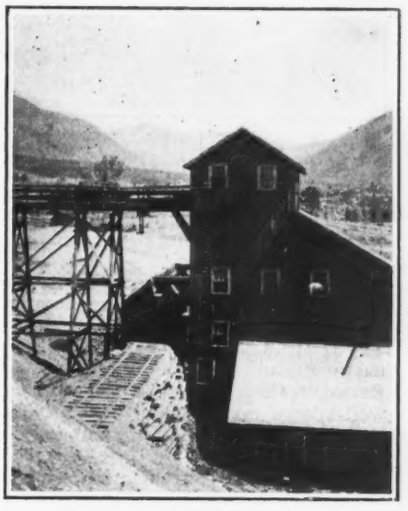
Portal of the Cowenhoven tunnel

This old adit has been reopened and equipped with electric haulage by the Aspen Mines Co.

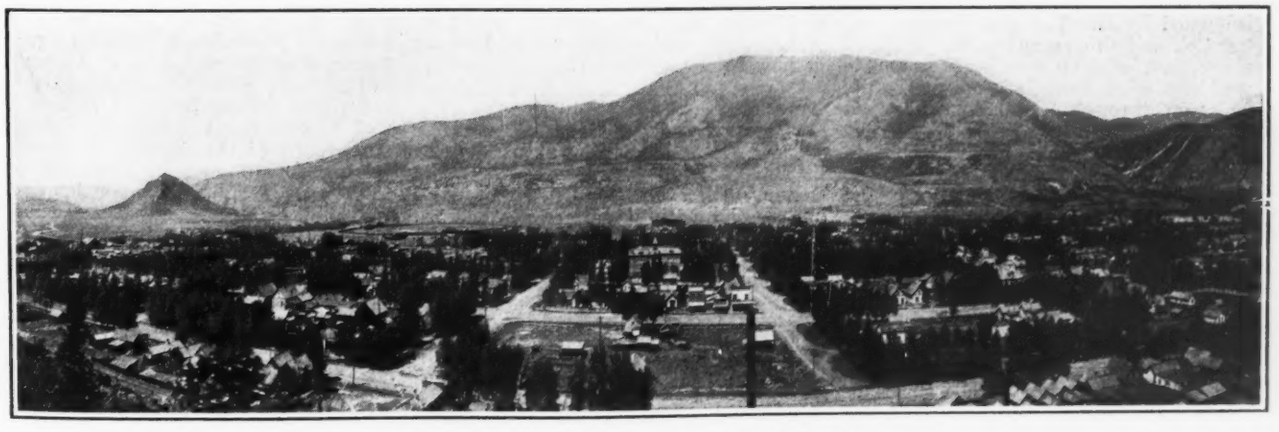
The Aspen Mines Co. is practically a reorganization of the Silver Mines Co., the capitalization having been reduced from $2,500,000 to $1,000,000, 50 per cent, or $500,000, remaining in the treasury. The transfer of Silver Mines stock was assessed 2c. per share, which raised $50,000 to equip the Cowenhoven tunnel group. The tunnel has been retimbered in the heaviest ground, new ore chutes at the different loading stations have been built, and several raises have been driven from the tunnel level. The tunnel has been re-equipped with electric power, air compressors and electric haulage. Development operations have opened up a number of the old stopes which are filled with ore of sufficient grade to show a fair profit, and several new orebodies have been opened.

The company operated the Hunter Creek mill for several months during the summer and fall of 1923. The recovery on the silver was not satisfactory, and improvements in the plant are planned.

The Aspen Smelting Co. has been organized primarily to build a smelter in Aspen. Storage bins, dust chambers, baghouse, and the other accessories are built for 300-ton capacity and several small Mace furnaces will be erected if present plans are carried out. The Aspen sampling plant has been purchased and will be moved to the smelter site. It is hoped that the enterprise will revive prosperity in the famous old silver-lead district.



Upper portion of the Hunter Creek mill, showing the tram track from the Cowenhoven tunnel



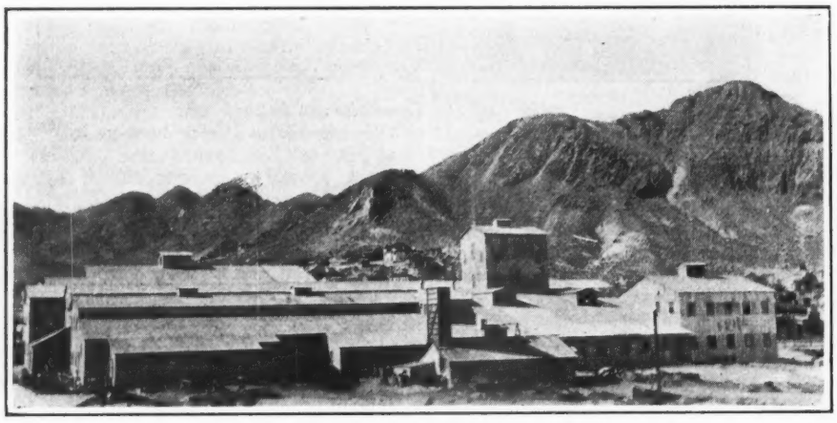
Aspen, famous old silver camp in Colorado

Smuggler mountain is at the extreme right, and at the left is Red Butte

Deep Exploration in Full Swing at Tonopah

Large Volume of Work Around Tonopah Extension and Halifax Tonopah Areas

THE discovery of rich ore at great depth in the property of the Tonopah Extension Mining Co. led to the belief that extensive exploration in other sections of the Tonopah district, in Nevada, would prove the existence of valuable deposits at a much greater depth than that which has been productive during the last twenty-four years. This conviction has finally taken concrete form and exploration at depth is in full swing.



Tonopah Extension mill

The area being mined at depth by the Tonopah Extension company is in the northwestern part of the district. The Halifax Tonopah is on the extreme eastern end of the productive area. Between these two are the numerous well-known mines which have produced millions in bullion and at comparatively shallow depth.

The Tonopah Extension Mining Co. is preparing to sink a new shaft 3,000 ft. west of the Victor shaft, which is the company's main shaft at present. This new shaft will be equipped with the most modern machinery and will eventually enable the Tonopah Extension Co. to explore the western area at a still greater depth than is now possible. East of the Victor shaft is the New Midway shaft. The Midway Co. is owned by the Tonopah Divide Mining Co., and this company has outlined a program of deep development and is well equipped financially to carry its program through. Sinking will start from the 1,600 level.

The Gipsy Queen Mining Co. lies to the north of the rich area mined by the Tonopah Belmont Development Co., the Tonopah Mining Co., the Montana Tonopah Mining Co. and the North Star Co. The Montana Tonopah Mining Co. has secured a lease on the property of the Gipsy Queen and has equipped the shaft with a steel headframe and other necessary equipment. Sinking was started from the 1,400-ft. point, and will be continued with a depth of 2,200 ft. as the objective.

The Tonopah Belmont Development Co. is doing extensive development work from its 1,500 level. In addition to the large area owned, the Belmont company controls the Jim Butler Tonopah Mining Co., to the south, and holds leases on the Mizpah Extension, lying to the northeast, the Boston Tonopah, northeast of the North Star, and the lower levels of the North Star mine, lying to the northwest. Three main crosscuts are being driven to the properties named. Storage-battery electric motors are used for handling material.

In the southeastern part of the district, the Red Hills Florence Mining Co., of Goldfield, will develop the Molly group. This work was scheduled to start on March 1, and operations will be conducted through the shaft of the Buckeye Belmont Mining Co., about 1,000 ft. to the north. This property lies about 2,000 ft. south of the Halifax mine. About 2,000 ft. north of the Halifax is an area which had not been considered worth prospecting until recently. It is likely, however, that a shaft will be started in this section with the purpose of exploring at depth.

As the Tonopah Keystone Mining Co. has recently resumed sinking in the southwestern portion of the district, it is apparent that the entire district is included in the program for development at depth. At no time in the last ten years has there been so great an amount of exploratory work done as is now being performed.

Penarroya Syndicate Cannot Increase Lead Output Quickly

The Penarroya Syndicate has been proceeding with its plans for the intensive development of the lead mines in southern Ciudad Real, adjacent to its smelters in the Province of Jaen, Spain. This syndicate is reported to be investing the equivalent of $5,000,000 in acquisition and development of the Ciudad Real lead mines, but the investment is not expected to result in any appreciable increase in the output of lead within the next two or three years, according to A. W. Ferrin, of the consular office at Madrid.

Development at Galena Mine in Idaho Seems Promising

Callahan Zinc-Lead Co. Hopes to Produce from Property—May Sink 400 Ft. Deeper

Since acquiring the property of the Galena Mining Co., about two years ago, the Callahan Zinc-Lead Co. of Wallace, Idaho, has been doing extensive development. Immediately after taking over the property, the 400-ft. shaft from the surface was sunk 200 ft. deeper, and at the same time drifting proceeded in the main tunnel just above the collar of the shaft. This latter work disclosed a long shoot of low-grade lead-silver "ore," but generally not of commercial grade. Upon the completion of the shaft, drifts were run on the 600 level east and west. In the east drift ore of milling grade was found for 350 ft., though the shoot was generally narrow, but apparently getting thicker with depth. The geological diagnosis of Walter Harvey Weed was substantiated by the work done.

A shaft was thereupon sunk on the ore 200 ft., and on this new level the vein is 12 ft. wide and has shown average assays of 4.8 per cent lead and 4.6 oz. in silver. Drifting is proceeding along the footwall, and the ore for the width of the drift, 5½ ft., averages 14.8 per cent lead and 11.4 oz. in silver. Conditions indicate continuity of this oreshoot and the management is now considering sinking the shaft 400 ft. deeper in preparation for production. Drifting west in what is known as the Kill Buck ground has also disclosed ore. With the exception of a comparatively small amount of zinc-lead ore in the upper workings, the original Callahan mine is practically exhausted, and the company is relying upon the Galena to restore it to production.

Stratton Has Paid Its Way To Date

Since the strike in the Stratton mine, near Wallace, Idaho, less than a year and a half ago, shipments have paid all expenses of development and the cost of much additional ground and on the first of the year there was a cash balance of $20,000 in the treasury. Having proved the oreshoot for more than 500 ft. in length, the company is now sinking on the ore, which has increased in thickness from 6 in. on the tunnel level to over 4 ft. at a depth of 50 ft. The Stratton company is now controlled by the Hercules Mining Co., and it is probable that it will duplicate the record of the famous Hercules by paying for its own development until it becomes a dividend payer.

Engels Earned $262,143 in 1924

The Engels Copper Co. reports an operating profit of $262,143 in 1924 after all charges except depreciation and mine development. Income was $1,256,845; operating expenses were $994,702; development cost $80,602; depreciation reserve was $151,581; and the balance after depreciation, to profit and loss, was $29,958. The production for 1924 was 12,870,111 lb. of copper.

Labor Situation Will Hold Down Michigan Copper Output

Whether additional shafts will be opened on the Osceola lode by Calumet & Hecla Consolidated will depend as much on the labor situation as on the metal market. Experienced miners, particularly, are scarce, and with the coming of spring all of the mines will lose a considerable number of men to the farms. No. 14 shaft, Osceola amygdaloid, recently reopened, is increasing production, which will be brought up to 1,200 tons daily. Production from North Kearsarge No. 1 shaft still is small, but will be gradually increased. Isle Royale, a subsidiary of Calumet & Hecla Consolidated, has increased tonnage somewhat, more miners having been employed in the last few months.

North Star Mines Lets Contract To Sink 2,200 Feet

The North Star Mines Co., of Grass Valley, Calif., has let a contract to Thomas Gill for sinking its vertical shaft an additional 2,200 ft. Two winzes will also be sunk to connect with the levels from the vertical shaft. It is reported that the new development will cost about $500,000. The vertical depth to be attained is 3,800 ft.

At the Empire Mines, the working force of 500 has been reduced to 400 men. At the Osceola mine, west of Grass Valley, leasers have taken out several rich oreshoots and are continuing work at depth. In the Alleghany district, the Rainbow, under option to the North Star company, is continuing to find high-grade ore.

Resume Work at Buckhorn Mine, Near Loveland, Colorado

The Buckhorn Gold Mining & Milling Co. has resumed operations on its property located in the mountains west of Loveland, Larimer County, Colo. A crew of men is working on the road leading to the old mine preparatory to, it is said, extensive development work during the present year.

For many years there has existed a strong belief that gold in paying quantities could be found along the Buckhorn, and the old mill was built for the development of this territory. During the war operations closed on account of adverse conditions and dissention among the stockholders.

With the resumption of the mill, it is believed that there will be a large influx of miners and prospectors, to the district. Surface conditions appear promising.

Butte-Burlington Starts in "West Side" Area

The Butte-Burlington Mining Co., which controls the Montana, Black Warrior, and Tiger claims, all near the Bluebird and Nettie mines, in Montana (both large producers of the past), has purchased and installed machinery on the Black Warrior property. Work has been started, and the crew will be increased as fast as developments justify. The property is situated in Butte's West Side mining district.

Washington News

By Paul Wooton
Special Correspondent

Pittman Will Reintroduce Silver Purchase Resolution

Died in Last Session Because of Protest of One Senator—Proposed Legislation May Pass in 1925

What is characterized by Senator Phipps, of Colorado, as the arbitrary objection of a single Senator, who had no knowledge of the merits of the legislation, caused the failure of Senator Pittman's resolution instructing the Secretary of the Treasury to complete the purchases of silver provided for under the original Pittman Act. It happens that this particular Senator, who has been a thorn in the side of the Secretary of the Treasury throughout the Congress just ended, unwittingly sustained the Treasury officials in their very determined fight to prevent further purchases of silver under the Pittman Act. It was for this attitude that these officials were rebuked by the House Committee on Banking and Currency. As a result of this objection the opportunity of bringing the bill to a vote in the House was lost and the legislation died with the Congress.

Senator Pittman has announced that he will reintroduce his resolution and press it for early action as soon as Congress reassembles. He points out that the legislation then will have the advantage of the progress made at this session. Ordinarily a new Congress is willing to permit such a measure as this to retain quickly its status at the time of the end of the preceding Congress. In view of the vigorous recommendations of both the Senate and House committees at the last session, the probabilities favor the enactment of this legislation before the end of the calendar year.

Hecla Shipped 41,815 Tons Ore and Concentrate in 1924

In his report to the stockholders for the year 1924, James F. McCarthy, of Wallace, Idaho, president and general manager of the Hecla Mining Co., estimates ore reserves at the close of the year at 1,831,900 tons, without taking into account ore below the 2,000 level, which was proved to a depth of 400 ft. by a shaft sunk from that level. During the year the company paid $1,000,000 in dividends, bringing the total distribution by the company up to $12,105,000.

During the year the Hecla company shipped 41,815 tons of concentrates and crude ore, having a value of $3,019,836.76, or $72.219 per ton. Cost of production, $1,309,392.07, or $31.314 per ton. Operating profit was $1,759,839 and in addition $309,418 was received from use and occupancy insurance. During the year the company produced 1,106,398 oz. of silver and 39,763,267 lb. of lead. It required 6.65 tons of milling ore to produce one ton of concentrates, and 5.81 tons of material treated to produce one ton of shipping product.

Senate Gold-Silver Commission Opposed by Reed Smoot

Senator Represents Utah, Important Mining State—Dawes Commends Work on Finance

Opposition in the Senate to the continuation of the Commission of Gold and Silver Inquiry was sufficiently strong to prevent any consideration of the merits of the question during the closing hours of the late Congress. Though it is believed that the members who are opposed to the continuation of the commission constitute a minority of the Senate, the influence of that minority, among whom Senator Smoot, of Utah, seemed to be the leader, was sufficient to prevent the Committee on Audit and Control from bringing out a report on the resolution proposing the continuance of the commission during the next Congress.

Senator Oddie, of Nevada, the chairman of the commission, finally persuaded the committee to report the resolution without recommendation so to thresh the matter out on the floor of the Senate. The legislative congestion, however, had become so great by that time that it would not have been advisable to have brought up the resolution. In view of those circumstances, Senator Oddie determined to make his fight before the extra session of the Senate. As a result he has reintroduced his resolution.

In the meantime, however, the continuation of the commission is being urged by financial and business interests not concerned primarily in mining. Their interest comes from the desire to continue the study of the European currency and finance and to encourage a return to the gold standard. Among the champions of the commission is numbered the new vice-president. General Dawes, in a letter to Senator Oddie written on the eve of his accession to his new post, speaks highly of the commission's work on European currency and finance. He characterizes its recent report on that portion of its work as "unusual" and of "extreme value." Continuing, he said: "In the selection of those who have contributed papers on currency and finance, exceptional judgment has been shown. The book is invaluable and most opportune. It is so timely as to be almost providential. You and your commission are to be congratulated upon a contribution which is of immediate use to the economic, banking, agricultural, and commercial interests of the nation."

Resumption of Work at Alta, Utah

At Alta, Utah, the Columbus-Rexall and the adjoining West Toledo companies are planning increased activity. At the former development work is being done, and arrangements are being made to increase ore shipments. The West Toledo will soon begin shipping from an orebody said to be 200 ft. long and 10 ft. thick. This was abandoned when lead prices were too low to permit of its profitable exploitation. The ore can now be shipped at a profit. The Howells mine, in Big Cottonwood Canyon, near the Cardiff, is resuming work.

London Letter

By W. A. Doman
Special Correspondent

Burma Mines Fire Signal for Bear Attack in London

Management Hope To Maintain 80 Per Cent Production—South African Gold Situation Not "Too" Bright

London, Feb. 24—Much disappointment has been felt at the fire in the Burma Corporation mine. Not fewer than 56 per cent of the stopes are shut off, and although the management hopes to maintain the output at 75 to 80 per cent of normal, it is doubtful whether this can be accomplished. Apparently, it is the timber which is burning, and though some people affect to treat this lightly others regard it seriously. One engineer has expressed the opinion that if the fire is not soon overcome the character of the ore may be changed, to the detriment of recovery. In the belief that something of this sort will happen, the "bears" have taken the matter in hand and have sold forward as far as June next. A figure of 8s. as against the existing price of 12s. 6d. is talked of. An analogy is made with the fire in the Central mine, at Broken Hill (Australia), owned by the Sulphide Corporation, which has cost £200,000 already.

South African mining shares at the moment are not wanted. Many of them are held for investment purposes on account of the relatively high yield, but the threatened legislation of the Union Government is causing much uneasiness. The wages question is again to the fore, and Justice de Villiers has decided that a 20 per cent permanent increase is necessary. About 15 per cent has been granted already, so that the balance is not of much importance. The point is, however, that the government takes it upon itself to determine whether a company can pay the extra. If an *ad misericordiam* plea is advanced, the authorities will decide as to whether the mine shall be shut down. When the bulk of the increase was conceded there was a premium on gold; this has now disappeared, and shareholders will not continue working indefinitely without some reward. Both this and the proposals with respect to the diamond trade seem to be due to political influences. Some of the members of the government made extravagant promises at the election, and now have to fulfil them.

Though the share market is dull, interest in copper properties in Rhodesia is by no means slack. A new company named the Northern Rhodesia Co. has been registered, with a capital of £100,000 in 5s. shares, to acquire mining or other rights in Rhodesia or elsewhere and to adopt an agreement with the Rhodesian Copper & Tin Exploration & Finance Co., the Bechuanaland Exploration Co., and Bwana M'Kubwa.

Registered about eleven years ago, Plymouth Consolidated Gold Mines has now to be put into liquidation. It acquired certain properties situated on the Mother Lode in Amador County, Calif., for a consideration of £77,852 cash and £127,000 in fully paid £1 shares. Although the company has paid six dividends, amounting to 65 per cent, working expenses in 1923 were 33s. 9d. per ton, while the yield of gold was only 27s. 1d. per ton. Attempts have been made to raise further funds, but even a high rate of 10 per cent has not attracted investors, with the result mentioned.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Recent La Rose Developments May Make New Mine

Dome Production Rate Higher — Hollinger Postpones Report Pending Sale of Hydro-electric Plant

Toronto, March 7—The annual report of the La Rose Mines Co., of Cobalt, for 1924 shows a gross value of ore shipped during the year of $79,000, while costs amounted to $137,355, showing a loss of approximately $58,000. The balance remaining in the surplus account stands at $101,874, compared with $173,582 in the preceding year, a net decrease of $71,708. The president reports that the recent discoveries below the 830 level are extremely important. The winze below the 830 level continued in high-grade milling rock to 855 ft., at which point it is understood that high-grade ore has again been encountered. Production to date from this new discovery amounts to 50,000 oz. and it may be of sufficient importance entirely to rehabilitate the position of the company. During the closing days of 1924, this stock was selling for about 5c. a share, but as a result of the new ore the stock market value increased to around 50c.

February production of the Dome mines, in Porcupine, amounted to $345,478, compared with $351,301 in January. Although the gross production is lower than for the preceding month, the daily recovery was higher, the difference being accounted for by the short month. The annual meeting of the company will be held in Toronto on April 14.

The date of the Hollinger annual meeting has not yet been announced, and the time has passed when, under ordinary circumstances, the annual report would have been mailed to shareholders. It is understood that the company is holding off in the hope that the hydro-electric plant will be disposed of, so that this news will be available for shareholders in the annual report and the company be in a position to make some definite pronouncement regarding the increase in dividend which is expected as soon as this matter is settled.

The annual report of the Northern Ontario Light & Power Co., which supplies the Cobalt camp with air and electric power and the Kirkland camp with electric energy, seems to be a fair indication of the increased prosperity in these two camps. The operating revenues amounted to $1,295,820, an increase of $245,580 and a new high record in the history of the company.

Melbourne Letter

By Peter G. Tait
Special Correspondent

Seek Funds To Exploit New Zealand Quicksilver Deposit

Commission Will Study Gold Mining and Treatment Methods in Western Australia

Melbourne, Feb. 1—The Geological Survey of New South Wales outlines attempts made to develop the cinnabar deposits in the state. As long ago as 1869 cinnabar was discovered near Mudgee, but to date the production has been very small, notwithstanding the fact that reduction works were erected at Pulganbar and Yulgilbar, in the North Coast district. Quicksilver also occurs at Jamieson, in Victoria, and a little work has been done on it, but operations have not reached a commercial scale. An important deposit has been proved in New Zealand near Puhi Puhi. The latest report was to the effect that the New Zealand Quicksilver Mines, Ltd., which had installed a plant, was endeavoring to raise further capital in London.

The Ives Reward gold mine, at St. Ives, which was floated about the time of the Hampton Plains boom, has had its first crushing, 305 tons being treated for an average return of 9 dwt. 12 gr. per ton. The residues carried 1 dwt. 12 gr. Some disappointment has been expressed at this comparatively low yield, but the management states that low-grade ore was crushed and that subsequent crushings should show a better return.

The output of the Bendigo Mines during 1924 was only 25,919 oz., compared with 44,028 in 1923, and 54,291 oz. in 1922. It is the lowest output in the history of the field.

From time to time reports come to hand regarding rich gold discoveries in Northwest Australia. Some years ago George Laurie struck a rich deposit averaging 6 oz. per ton at Tanami, but in the absence of transport facilities, the lack of water, and the unsettled character of the region, no real progress has been possible. The high costs of mining undoubtedly damp the ardor of those who would otherwise be prepared to invest capital in the company which would be prepared to undertake exploration work in this comparatively unknown area.

The Western Australian government has appointed a commission of three to report on gold mining and treatment methods. The chairman of the commission is C. Kingsley Thomas, formerly of South Africa, and the other two members will be men with local experience. It is understood that the government has taken this step to ascertain whether the mining companies are keeping abreast of the times and doing all they possibly can to maintain the industry. So far no announcement has been made by the representatives of the companies as to their attitude, and it remains to be seen whether they will render hearty cooperation or simply permit the commissioners to get what information they can.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

HIGHER PRODUCTION RATES and increased activity in prospecting and exploration characterize the metal-mining situation. Even copper prospects are receiving attention in some instances—and it was not so long ago that the average undeveloped copper property was about as little coveted as anything could be. Now there seems to be a feeling in many quarters that by the time a property can be equipped and made ready for production a satisfactory market for the metal will be at hand. A large contingent of engineers and construction men has sailed for Chile to begin work at Anaconda's Andes property. In the southwest development work by the Canario, Kay, Verde Central, and others is being conducted on a good scale. Over in Northern Rhodesia, the Bwana M'Kubwa Copper Co. is about to build a large reduction plant for copper ores; and it is reported that the Granby Consolidated will resume production at its Allenby property, in British Columbia.

Energetic Exploration for Lead and Zinc

The search for zinc and lead ores goes on unabated. In the Joplin-Miami district drilling of new areas is unusually active; and in Colorado, Utah, Idaho, and British Columbia new prospects are being opened and old mines are being re-examined in the hope of finding available deposits of lead-silver, or even zinc ore. More digging in undeveloped territory than for many years marks current activity in the Tonopah silver camp, and Cobalt, Ont., is the scene of renewed exploration for silver ores.

Smelter settlements are not as high as they were earlier in the year, March 1 showing declines in the prices of all the major metals as compared with Feb. 1. Copper sagged from 14.5 to 14.25c., zinc from 7.40 to 7.25c., lead from 9.75 to 9.12c., and silver from 68⅞ to 68¼c. These, however, are high enough to stimulate output and to afford good profits to most of the companies that are now producing, unless an exception be made in the case of the less comfortably situated copper companies.

The aggregate rate of copper production is probably growing gradually, as a consequence of comparatively small increases on the part of many rather than of any startling changes in production policy of the larger interests. Anaconda and Utah Copper, reports indicate, are each close to 20,000,000 lb. per month, appreciably more than in recent months, although February's short month figures will not, of course, reflect current rates. Phelps Dodge, New Cornelia, and Nevada Consolidated are among those that are producing more. The Union Minière, in Africa, has fallen far from its high estate of last fall, the January figure being only 15,866,000 lb. The rain of the tropical season is probably a factor.

Lead mining may be gaged by smelter activity. In Utah, the United States and International companies each have recently added a furnace. The total number in blast, including Murray, is sixteen. At Leadville, Colo., the American Smelting & Refining Co. is running five lead furnaces for the first time in many years. At the Bunker Hill smelter, in Idaho, two large furnaces are making lead at the rate of 5,500 tons per month. The increases are accounted for in large measure by the increased number of small shippers.

Zinc output is likewise very high. For the first time on record 16,000 tons of "jack" has been produced in the Joplin-Miami district, that being the total for the last week of February. January also witnessed the making of another zinc record: Anaconda produced 15,700,000 lb. of the metal at its electrolytic refinery at Great Falls. Some of this came from British Columbia.

Gold and silver production is increasing in North America, principally because of the byproduct output from lead and copper ores. In California, the Plymouth gold mine, involved in litigation, has been shut down. The Moore mine has suspended production and the Empire and Eagle-Shawmut have curtailed. Offsetting this, in part, is increased activity in placer mining as a consequence of abundant rain and snow. The gold mines of Ontario are flourishing, Wright-Hargreaves, Lake Shore, and McIntyre doing better than ever before. Hollinger's output is at the rate of $1,200,000 per month.

The situation on Lake Superior iron ranges is good at the moment. A large proportion of the underground mines are producing at capacity, and stockpiles will be full by May 1. Open-pit equipment is being overhauled ready for heavy production. Stocks of ore on Lake Erie docks are said to be the lowest recorded in eight years, and a season of great activity is anticipated. The same situation existed a year ago, however, only to be followed by bitter disappointment. So, independent producers have the attitude of "wait and see."

Since Jan. 1 two wage raises have been made. The St. Joseph Lead Co. increased the scale 10 per cent in Southeastern Missouri, giving drill runners $5.05; and in the Coeur d'Alene a 50c. increase brought the base wage for miners to $6. Michigan copper companies declare that difficulty in getting underground workers is preventing them from expanding output as rapidly as they would like. So far no complaint is heard in other quarters.

In California the Empire Mines Co. has decided to sink an additional 2,000 ft. and both the Kennedy and Argonaut companies are opening ore on new low levels. The California Rand silver mine, under option for $2,500,000, made an excellent production record for January.

The Simon Silver Lead Co. plans to resume operation of its concentrator near Mina, Nev. The new camp of Gilbert, west of Tonopah, is thriving, and lessees have begun shipments.

The United States S. R. & M. Co. has announced that it will build a $500,000 flotation plant for the treatment of lead-zinc ores near its Midvale smelter, in Utah, and that it will be prepared to pay for both metals in customs ores. A rich shoot of lead-silver ore has been opened in the Utah-Apex mine, at Bingham, resulting in larger earnings.

Increased shipments from the Tamarack mine, and production of lead-zinc ore from the Star mine, in the Coeur d'Alene district in Idaho, will start soon. The Hercules company is actively exploring for a new mine. Henry Ford and the General Motors interests are opening the Red Bird and Livingston mines respectively in the Mackay district.

Anaconda's current copper production at Butte, Mont., is about 19,500,000 lb., and Butte & Superior is outputting about 1,250,000 lb. Elm Orlu is producing 4,000,000 lb. of zinc and Butte & Superior 5,000,000, but zinc ore reserves are said to be dwindling. The $300,000 manganese concentrator of the Philipsburg Mining Co. burned in February.

Miami Will Enlarge Concentrator to 10,000 Tons

The new sampling and ore-purchasing plant at Kingman, Ariz., has stimulated production by small operators. Reopening of its smelter at Humboldt is forecast by the Southwest Metals Co. if the copper market holds; Miami will increase its concentrator capacity to 10,000 tons per day; and United Verde will build a concentrator at Jerome—the first in that district. Shattuck Arizona will restart the Denn mill to concentrate lead ore at Bisbee.

A record of seven consecutive "million-dollar" weeks, with 158 concentrators in operation, reflects prosperity in the Joplin-Miami district. Nothing but a serious drop in the market for concentrate will stop production from exceeding 16,000 tons per week.

Construction of a 25,000-ton sulphuric acid plant by the Mond Nickel Co., at Sudbury, Ont., is announced. The company has effected important economies by installing magnetic belt sorters at the smelter. A 50-ton pilot concentrator is being built by the International Nickel Co.

In British Columbia the Consolidated Mining & Smelting Co. is producing more concentrate than the Trail reduction works can handle. Accordingly, 150 tons of lead concentrate is being shipped daily to Kellogg, Idaho, and 100 tons of zinc concentrate to Great Falls, Mont. This company has lowered its smelting charges on customs ore.

In spite of labor and tax laws that are uncertain and sometimes burdensome, operations are expanding in Mexico, both the large interests and smaller companies being active.

Men You Should Know About

Dr. Raymond C. Moore, State Geologist of Kansas, has recommended to the Kansas Legislature the passing of an appropriation bill providing for a broad campaign of geological research in the subject of petroleum development in Kansas.

Dr. Raymond C. Moore

Benjamin B. Thayer, vice-president of the Anaconda Copper Mining Co., is at Butte, Mont., on one of his periodical inspection trips.

M. Altmayer, of Paris, who has been in the United States since Feb. 1 investigating business conditions, sailed recently for home.

William C. Evans, master mechanic for the Walker copper mine, accompanied by his wife and family, will leave California early in March for Potrerillos, Chile, South America, where he will assume the position of master mechanic for the Andes Copper Mining Co., a subsidiary of the Anaconda Copper Mining Co.

Carlton D. Hulin's article on "Mineralization in the Vicinity of Randsburg, California," in our issue of March 7, through that fallibility which is occasionally inevitable in all human activities, contained an accidental transposition of captions under his illustrations.

Thomas F. Cole, of New York, was in Tonopah recently inspecting the work being done by the Montana Tonopah Mining Co. in the Gypsy Queen shaft. Mr. Cole was formerly associated with the Anaconda Copper Mining Co. and is a director of the Calumet & Arizona. and directly responsible for the financing of this new work. His son, **Fred L. Cole,** is superintending the work at Tonopah.

A. H. Simpson, who has been in charge of the Standard Minerals Co., in California, for the last five years, will leave that company on March 15 to assume supervisory direction of two properties at Randsburg, Calif—the Monarch Rand and the Twin Peaks. The Monarch Rand is situated between the Kelly and the Yellow Astor. It is just entering into production. The Twin Peaks, about eighteen miles from the Monarch Rand, is now producing.

Robert Dunn has been appointed acting Deputy Minister of Mines for British Columbia and will succeed **Roderick F. Tolmie,** the present Deputy Minister, on his retirement. For the last eight and a half years Mr. Dunn has been private secretary to the Minister of Mines. Prior to entering the government service Mr. Dunn was on the editorial staffs of *The Daily Colonist* and *The Daily Times,* of Victoria, B. C., and for a time he published *The Golden Star.* He was city editor of *The Daily Times.* During recent years he has been one of the British Columbia correspondents for *Mining Journal-Press, Coal Age,* and the *Canadian Mining Journal,* and has contributed a number of articles to those magazines.

Dr. Solon Shedd, State Geologist of Washington and head of the geology department at Washington State College, at Pullman, Wash., has been selected to take charge of the Brauner Memorial Geology Library at Stanford University in June, 1925.

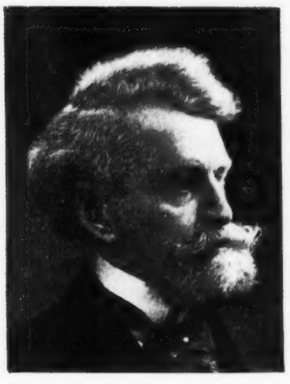
Dr. Solon Shedd

George Kingdon, manager of the United Verde Extension Mining Co., sailed for Europe and South Africa the latter part of February.

Obituary

William Andrews Clark

The death of William Andrews Clark in New York City on March 2 marked the end of the career of a truly remarkable American. Senator Clark was perhaps the last of that virile and indomitable band of pioneers whose achievements are the essence of the romantic dramas that followed the discovery of the great copper deposits of Montana and the West. He was born on a farm near Connellsville, Pa., on Jan. 8, 1839, the son of John and Mary Clark, and received his early education at the local schools and academies. After his family had moved to Iowa, Clark studied law—a profession he never practised. Going to the State of Montana in 1863, where he engaged in merchandising and other ventures, he was soon successful enough to buy both a newspaper and a bank, and when copper was discovered in Butte, with his brother James R. Clark he became interested in the Butte Reduction Works and in copper and silver mines, rapidly amassing a fortune, which he invested in a great variety of industrial enterprises in addition to mining. In the midst of a life filled with historic litigation, political rivalry, and incessant devotion to his business affairs, Senator Clark found time to take courses in mining and metallurgy at Columbia University and thoroughly to learn the art of assaying. He was, too, a soldier, having been a leader in the warfare against the Nez Percé Indians, attaining the rank of major. After his historic campaigns for election as United States Senator from Montana in 1890 and 1898, he was finally elected by the Legislature for the term beginning in 1901. Senator Clark later in life became a collector of art. His mansion on Fifth Avenue, New York, contains many famous canvases and tapestries. For many years past it had been the Senator's custom to invite the members of the A.I.M.E. and the Women's Auxiliary to inspect his art treasures during the course of the annual February meeting in New York. At the time of his death he was president of the United Verde Copper Co., in which he acquired a large interest about 1890, his attention having been directed to the great value of that property by James A. MacDonald, now vice-president of the company, and probably, next to Senator Clark, its most important stockholder. He was also a director in many other corporations. Senator Clark had been in excellent health until a few days before his death, which resulted from pneumonia, and his passing, despite his years, came as a surprise and shock to a host of business associates and friends.



William Andrews Clark

Reginald E. Callow, mining engineer and analytical chemist, born in Sydney, Australia, died in Cananea, Sonora, Mexico, on Feb. 5, 1925.

Societies, Addresses, and Reports

Canadian Engineers Gather at Ottawa

C.I.M.M. Holds Annual Meeting at Victoria Memorial Museum—T. J. Brown, of Nova Scotia, Elected President

By George C. Bateman

THE twenty-seventh annual meeting of the Canadian Institute of Mining and Metallurgy was held in Ottawa on March 4, 5, and 6, the headquarters being in the Victoria Memorial Museum. Ottawa can claim many advantages as a meeting place, as it is the capital of the Dominion Government, and, having the government buildings, Mines Branch and the Royal Mint, there are many places of interest for the visitors. An unusually large number of ladies were present from outside points, and several visitors from the United States, among them being E. P. Mathewson, Colonel Arthur S. Dwight, J. E. Spurr, and Louis D. Huntoon.

One of the features of the Canadian Institute meetings is the presentation of the Dominion and provincial reviews of production for the preceding years, which are made public for the first time at these meetings. S. J. Cook, of the Dominion Bureau of Statistics, stated that the Canadian mineral output for 1924 was valued at $209,516,465, which total has been exceeded in only three previous years — namely, 1923, 1920, and 1918. The falling off was due to the decrease in the non-metallics, chiefly coal, on account of the strike in the western mines. Primary metals produced during the last year reached a total value of $102,900,000, an increase of more than $18,600,000 compared with 1923. On the other hand non-metallic minerals and structural materials, the value of which was $106,500,000, showed a loss of $23,100,000. Gold production valued at $31,346,000 reached a new high level, and of this more than 80 per cent was produced from Ontario. Of the silver production of 20,244,000 oz., valued at $13,519,000, more than half came from Ontario mines and most of the rest from British Columbia. Nickel production was 69,687,000 lb., an increase of more than 7,000,000 lb., and copper production, with a total of 106,351,000 lb., showed an increase of 22.4 per cent. Lead established a new high record at 177,756,000 lb., and zinc production at 98,789,000 lb. also reached a new high level. This production included 54,888,000 lb. of refined zinc produced at Trail, the remainder being the estimated recovery of the zinc in ores exported for treatment. Sales of cobalt and its compounds were well maintained throughout 1924, but white arsenic, at 4,672,000 lb., showed a decrease of 27.3 per cent in quantity and 43.8 per cent in value. Coal production showed a disappointing drop of approximately 3,300,000 tons, valued at $17,800,000, the total being 13,600,000 tons, valued at $54,885,000. Asbestos production was 220,000 tons, valued at $6,590,000, a decrease of 5 per cent. Gypsum valued at $2,199,000 showed an increase of 11½ per cent, and cement sales declined $1,600,000 in value to $13,445,000. Brick, tile, stone, sand, and gravel sales were all slightly below the totals for 1923.

Metal Production of Ontario Increases

Figures for Ontario, presented by W. R. Rogers, showed a total production valued at $74,412,000, compared with $71,682,000 in the preceding year. The value of the metallic production was $51,608,000, an increase of $7,500,000, and the non-metallics, construction materials, and clay products all showed decreases. Gold contributed the largest amount of the metals, the production being valued at $25,675,000, an increase of 27.8 per cent, and the production for the year constituted a new high record in the history of gold mining in the province. Silver, valued at $6,692,000, showed a small decrease; copper produced and exported in matte valued at $3,800,000 was an increase over the preceding year. The total value of the metallic nickel, nickel oxide, and nickel exported in matte was $11,300,000, an increase of $1,800,000. The most important event in the nickel industry was the assignment of the British America Nickel Corporation in July, but in spite of this total production was increased. Non-metallic minerals reached a value of $7,677,000, construction materials $10,737,000, and clay production $4,390,000.

Rouyn the Outstanding Feature

The promising development of the Rouyn gold area was reported as the most outstanding feature of the mineral production records of Quebec, presented by Theodore C. Dennis. Sales of asbestos were fairly well maintained, with large export shipments to the United States and European points, but the 1924 production, valued at $6,562,000, showed a decrease of approximately $800,000. Quebec metallic mineral output for the year showed a total of $833,000, and construction materials, including clay products, were valued at $10,861,000. Non-metallic minerals, including asbestos, amounted to $7,088,000, giving a total value for Quebec's output of $18,722,000.

W. Fleet Robertson, who has just retired as Provincial Mineralogist of British Columbia after twenty-seven years of service, presented the report for his province. British Columbia experienced the most successful year in all branches of mining except coal. Many new mines were opened, and the tonnage of ore received at the Trail smelter greatly exceeded that of the previous year. The copper-smelting department was reopened in May, the lead department increased its output substantially, and sales of zinc concentrates to Belgium were now a feature. The total mineral output of British Columbia in 1924 was valued at $51,878,000, or 24.8 per cent of the entire Canadian production and about $8,000,000 higher than the total for 1923. In order of value the principal products were lead, coal, copper, zinc, gold, and silver.

Exports of arsenical gold concentrates to the United States valued at $37,000 were the only items in the metallic mineral production for Nova Scotia. The output of coal mines was valued at $23,381,000, a decrease of $4,800,000 compared with 1923. Depression of the iron and steel industries of the Sydney districts was noteworthy. There was the customary production of salts from the Malagash districts. The output of gypsum, valued at $905,000, was higher. Production figures for this mineral were considerably increased. The total production from the province was valued at $24,916,000.

In New Brunswick the mineral production was valued at $2,049,000, the principal items being coal and gypsum.

Dr. Uglow Receives Leonard Medal

The first morning of the meeting was given over largely to official business of the Institute, which included the presentation of the Leonard gold medal of 1924 to Dr. W. L. Uglow, of the University of British Columbia, for his paper "The Undiscovered Mines of British Columbia." There was also some discussion regarding the proposed memorial to the late Dr. W. G. Miller, regarding which the Institute will take some action.

The afternoon session was comparatively short, as Dr. Charles Camsell's paper on "The Mineral Trade of Canada" was not read and E. S. Moore was sick and unable to present his paper on "Iron Ore Deposits." G. C. Bateman presented a paper on "Foreign Investment in Canadian Mines," giving figures showing the ownership of securities in the different groups of mines by citizens of Canada, the United States, and Great Britain. It was pointed out that the English investor, owning a little more than 3 per cent of the gold-mine securities, had missed his opportunity and that if this percentage had been larger and been more widely and wisely distributed it would have been much more profitable. He also stressed the fact that money was coming into the country which was not wanted, as it was of no benefit to the investor or the industry and it was the duty of the Institute to either try to keep this money out, or direct it into channels from which both the investor and the industry would profit. F. Lathe presented a paper on "Feeding Blast Furnaces to Save Coke," which detailed important savings which had been made in the operation of the British America Nickel Corporation's furnaces by close attention to feeding.

At the Thursday morning session, sectional papers were read on recent developments in mining in Canada. J. F. Wright covered the discoveries of copper and copper-nickel deposits of southeastern Manitoba. Interesting deposits have been found and considerable work has been done, but not suffi-

cient to demonstrate large orebodies on any one property. A. G. Burrows covered Ontario in a comprehensive manner, dealing particularly with the favorable geological features surrounding the gold mines in the province. H. C. Cook dealt with northwestern Quebec, which is known as the gold camp, but where copper-gold ores are the most important so far discovered. Recent discoveries taken in conjunction with the original drilling done on the Cochrane properties, which was the first diamond drilling done in the district, indicate an extension of the Horne copper belt to the northwest. Prospecting during 1924 was very active, a number of discoveries being made, and the district holds out considerable promise as a gold producer.

The rest of the morning was taken up by some excellent coal papers by J. A. Allen and E. Stansfield, of Alberta, and by B. R. MacKay, of the Mines Branch.

In the afternoon W. A. Parks, of the University of Toronto, read a paper on "The Building Stones of Canada," and there were also papers by W. E. Austin and G. E. Cole on gypsum in Manitoba and Ontario, where important industries have been built up. It was pointed out that the tendency is for metallic mines to monopolize attention.

G. C. Riley, speaking on "Explosives in Modern Mining," pointed out that the explosives industry has outgrown mining and stressed the necessity for the employment of explosives engineers, so as to get the most efficient and economical results.

Thusday evening a *conversazione* was held in the Victoria Museum, under the patronage of the Governor General and Lady Byng. This was one of the best features of the entire program and was attended by almost 600. There were a large number of interesting exhibits in charge of members of the Geological Survey and the Mines Branch and in the lecture room an illustrated ramble through "Wembley" was presented, followed by a well-acted playlet.

One of the most interesting exhibits was that of glass blowing by an employee of the Mines Branch who makes the chemical apparatus for the staff and also makes the vacuum flasks for testing coal-mine gas, a service which is rendered free to the operators. However, on this particular evening Mr. Langley, who is a real artist, confined himself to making delicate and beautiful articles, which included souvenirs for the ladies. The evening ended with a dance, which was well attended.

Friday morning was given over to a symposium of some non-metallic minerals by members of the Mines Branch and covered asbestos, sodium and magnesium salts, silica, feldspar, mica, graphite, barytes, talc and soapstone.

Among the contributions was an exceedingly comprehensive paper presenting a review of changes that have taken place in these industries in Canada during the last fifteen years. Papers were also presented by other members of the Mines Branch covering natural gas, bituminous sands, and oil shales.

There was no technical session on Friday afternoon, but excursions were run to a local brick plant, the Dominion Observatory, the Mines Branch Testing Laboratories, and the Royal Mint, which is the largest and finest mint on the continent and is under the control of the British Government.

The annual banquet was held in the evening, and for the first time in the history of the Canadian Institute there was a dinner-dance. It was also the second time at which ladies were present at the annual banquet, the precedent having been established in Ottawa some years ago. This time, however, the ladies were out in force. Also, for the first time in the history of the Institute, speeches were broadcast. The principal speakers were the Hon. Charles Stewart, Minister of Mines for the Dominion, and the Hon. Charles McCrea, Minister for Ontario. Messrs. E. P. Mathewson and J. E. Spurr responded to the toast to the visitors. An interesting feature of the dinner was the presentation to Dr. Charles Camsell, Deputy Minister of Mines for the Dominion, of a gold watch and chain. This presentation was contributed by the individual members of the Institute in recognition of Dr. Camsell's many admirable qualities and the services he has rendered to the Institute.

T. J. Brown, Deputy Minister of Mines for Nova Scotia, was elected president of the Institute for 1925.

Rolla Student Society Arranges Program of Addresses

Addresses on subjects allied with mining by various speakers have been arranged by the Mining and Metallurgical Association of the Missouri School of Mines for the spring term. It is planned to have two meetings a month. The program will include:

R. C. Allen, of Olegbay, Norton & Co., of Cleveland, on "Ore Producers' Associations."

H. F. Frey, certified public accountant of Chicago, on the "Application of the Mining Industry to the Taxation Laws."

J. E. Spurr, editor of *Mining Journal-Press*, on "Ore Deposits" or "Finance."

P. B. Butler, of the Barnsdale Corporation, on "Mine Management."

P. N. Moore, consulting engineer of St. Louis, on "Engineering Education."

B. O. Mahoffey, of the Silurian Oil Co., on the "Oil and Gas Business."

Wade Kurtz, of Baird, Kurtz & Dobson, on the "Relations Between the Mining Engineer, the Accountant, and the Business Man."

C. T. Orr of Athletic Mining & Smelting Co., on the "Co-ordination of Producers and Consumers."

Engineering Foundation Now Represented at Salt Lake

The Utah engineers who have been chosen to represent the Engineering Foundation at Salt Lake City are: S. O. Cannon, H. W. Clark, Wilford Y. Cannon, Utah-Idaho Sugar Co.; R. A. Hart, Department of Agriculture, Bureau of Public Roads; H. T. Plumb, General Electric Co., and C. T. Van Winkle.

San Francisco Section of Institute Discusses Employment Bureau

At the regular monthly meeting of the San Francisco Section of the American Institute of Mining and Metallurgical Engineers on Feb. 18, 1925, a communication was received from the employment section of the four founder societies, proposing to establish an employment section in San Francisco for engineers and offering to give a revolving fund of $3,600 for the purpose of establishing the local employment section. The basis of the plan is to employ a secretary to take charge of the work. The section appointed a committee to consider the proposal. It is expected that the employment section will be established.

Walter Stalder, the speaker of the evening, discussed in detail, illustrated by charts and maps, the geological interpretation of recent oil-field developments in Kern County, Calif.

British Iron and Steel Men To Meet in May

The Iron and Steel Institute will hold its annual general meeting May 7 and 8 at the House of the Institution of Civil Engineers in London. The annual dinner will take place on May 7 at the Hotel Cecil.

Members have been reminded that in March the council will consider applications for grants from the Carnegie Fund, in aid of research work on some subject of practical importance relating to the metallurgy of iron and steel, or allied subjects. Special application forms can be obtained from the Secretary of the Institute. The results of research work must be communicated to the Institute in the form of a report.

The autumn meeting will be held in Birmingham, England, Sept. 9, 10, and 11. Further details of the arrangements will be announced later by the secretary.

Minnesota Engineers Dine

The annual banquet of the Engineers' Club of Northern Minnesota was held at Eveleth on Feb. 28. Announcement of the affair had been made well in advance, the printed invitations being arranged in the form of an engineer's specifications.

A.S.T.M. Will Meet June 22-26

As previously announced, the twenty-eighth annual meeting of the American Society for Testing Materials will be held at Chalfonte-Haddon Hall, at Atlantic City, N. J., during the week of June 22. As in previous years, Monday will be devoted to committee meetings, with the first session of the annual meeting probably on the afternoon of Tuesday, June 23, and the closing session on Friday evening, June 26. It will be necessary, as in the last few years, to hold a number of simultaneous sessions. A provisional program will be mailed to the members late in April with the next issue of the *Bulletin* printed by the society.

Recent Technical Publications

Reviews, Abstracts, and References

An Outstanding Work on Metallography

The Science of Metals. By Zay Jeffries and Robert S. Archer. McGraw-Hill Book Co., New York. Price $5.

As the authors point out in the preface, we have a great store of facts about the structure and properties of metals and alloys, and what we need is a better classification of this knowledge, so that we can understand the underlying principles. This need has been supplied by Jeffries and Archer in a most logical and readable manner, and they are to be congratulated on giving us something well worth while; something quite new and along original lines, and yet always essentially practical. It will appeal to the engineer in a way which previous books on metallography have failed to do. This book is not a composite of previous books, padded here and there with more or less new material—it is absolutely original from beginning to end. To the teacher of metallurgy who strives to something more than setting forth the facts accumulated since the art began, it will appeal as few books have done, because it gives the "reasons why" underlying the science of working in metals.

The treatment of the subject can be gathered from the titles of the twelve chapters. The introduction covers definitions of structure, physical properties, and methods of testing metals and alloys. Then follow Electrons, Atoms and Molecules; the Crystalline Structure of Metals; the Amorphous Metal Hypothesis; Grain Growth and Recrystallization; Mechanical Properties of Metals; Compounds of Metals; Metallic Solid Solutions; Constitution of Alloys; Structure and Properties of Aggregates; Hardness of Metals; and the Hardening of Steel.

We have known for some time that the properties of metals are intimately related to the size and shape of their grains or crystals, and now, by means of the X-ray spectrometer, the actual arrangement of the atoms in crystals and even the distances between atom centers is being determined, and a new field of attack is being opened up.

As the essence of crystallinity lies in regularity of internal structure, all metals are crystalline. This crystallinity depends on orderly arrangement of the molecules, and hence the first point discussed is space lattices, which determine the orientation of crystal faces. Further, crystalline materials break easily along certain cleavage planes, and deformation of metals takes place by sliding on slip planes. All of these planes pass through atomic centers in the space lattice. Most metals crystallize in the cubic system—tin and indium are tetragonal, and magnesium, zinc, and cadmium belong to the hexagonal system. When a metal is strained beyond its elastic limit, slip along crystallographic planes or slip planes produces block movement. The original equiaxed grains are drawn out and the change in external shape of each grain is compounded of a multitude of minute slips. With extreme cold work the metal takes on a fibrous appearance. If cold-worked metal is heated to the annealing or recrystallization temperature, a new system of equiaxed grains is produced. The higher the temperature, the coarser the grains. If, however, the work on a metal is done above the recrystallizing temperature, the metal anneals or recrystallizes during the process and is said to be hot-worked. Such hot-worked or annealed metal usually shows twinning of the grains.

Beilby set forth the amorphous metal hypothesis in 1911, that the hardening produced by cold work was due to films of amorphous material produced on the faces of slip. This was extended by Rosenhain, who said that the grains of a metal are held together by similar amorphous cement. The authors show that Beilby's original hypothesis is untenable and that strain hardness is caused by slip interference created by grain fragmentation of the original grains, the importance attached to the specific hardness of amorphous metal as a cause of hardening having been greatly exaggerated.

The discussion of grain growth and recrystallization is perhaps the most interesting of all. The authors lay down certain laws of grain growth. Though many of these have been taken for granted for a long time, some of them are not so well known in practice.

The grain size in cast metals that undergo no phase change in the solid state cannot be changed by annealing. Grain growth in the solid state does occur in worked metals and compressed powders, as well as in electrodeposited metals, in iron when it changes its allotropic form, and in certain alloys in which a new phase is formed in the solid state. The recrystallization temperature is lower the greater the amount of deformation; the smaller the grains prior to cold work, the purer the metal, the lower the temperature at which cold work is effected, and the longer the time of heating.

In any given metal, the grain size, after complete recrystallization, is normally smaller the lower the recrystallization temperature. Certain conditions of non-uniformity sometimes give rise to abnormally large grains. This was investigated by Stead in low-carbon steel, and is hence called Stead's brittleness. In general, it has been referred to as germination. These conditions are grain-size contrast, strain gradients, temperature gradients, concentration gradients, and obstruction gradients. The presence of foreign matter or a second phase causes mechanical obstruction to grain growth.

Cold work produces a structure which simulates in many respects that of a very fine-grained metal. The main cause of strain hardening is the slip interference resulting from the disregistry of slip planes at the boundaries of grain fragments. An additional cause of strain hardening is the disorganized layer of atoms at self-stopping slip planes, and the amorphous metal added at the old grain boundaries.

The cohesion of pure metals is entirely sufficient to account for the maximum hardness of the alloys of the metals. Mechanical failure under stress is usually premature and due to potential slip planes which allow sliding of one crystal fragment on another at loads much lower than the absolute cohesion. Any structural condition that interferes with this slip increases the strength and hardness, and every known method of hardening metals can be explained by this principle of slip interference. The effective hardness is obtained by slip interference of very fine particles of a hard constituent. The effect of a given amount of this hard constituent increases with the fineness of subdivision, reaching a maximum at what is called the critical dispersion, and this is probably the particle size having the characteristic properties of the crystalline substance. The atomic dispersion of solid solutions is less conductive to hardness. The manner in which the greatest degree of dispersion is produced is the limited decomposition of solid solutions.

The slip-interference theory applied to the hardening of steel is so simple that it seems almost astonishing that it was not put forth years ago, but steel was put in a class by itself, and the nature of its hardening was considered abnormal. The increased strength and hardness of pearlite compared with pure iron are due largely to the increased resistance to slip brought about by the hard cementite. Martensite, troostite, and sorbite all consist of ferrite and finely dispersed carbide particles. Sorbite and troostite are harder than pearlite because of the refining of the ferrite grains and the greater dispersion of the cementite particles. The greatly increased hardness of martensite is due to a still greater refining of the ferrite grains and the critical dispersion of the cementite particles. Austenite contains carbon in solution as such. It is not there as dissolved cementite. Cementite exists only by precipitation from austenite.

The properties of high-speed steel are just as easily explained as those of ordinary steel and are based on the excess carbide present. The reason why high-speed steel does not undergo grain growth through hardening at a white heat is due to obstruction of the residual carbide particles. The reason for its retention of hardness to a red heat is because the iron-tungsten-carbide particles reach approximately the size for critical dispersion at about 600° C.

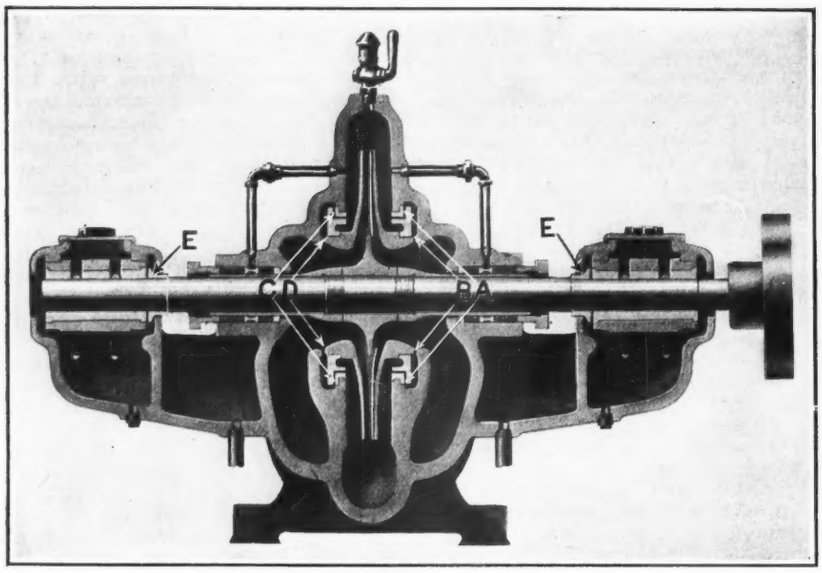
In what has been here set forth an attempt has been made to emphasize some of the important points brought out in this book. To cover them all would take pages. In the past our books on metallography have been mainly for the specialists, and the everyday engineer did not know the language. This book demands only one prerequisite—the little chemistry and physics we remember from our school work. It contains nothing but common sense and clear thinking.

WILLIAM CAMPBELL.

New Machinery and Inventions

Eliminating End Thrust in Double Suction Pump

A line of double suction centrifugal pumps, in which a means of neutralizing end thrust automatically has been incorporated, has been developed by the Earle Gear & Machine Co., Philadelphia, Pa. Theoretically, a double suction pump, if properly designed, has no end thrust, but it is a fact that end thrust or unbalanced pressure on the sides of the impeller is likely to result because it is impossible to obtain absolutely accurate castings for the pump casing or the impeller, and very small and apparently insignificant variations in the shape, smoothness, or size of the casing or impeller water spaces give rise to large differences of pressure on the sides of the impeller. A sectional view of one of the new pumps is shown.



Double suction centrifugal pump designed to eliminate end thrust

The unbalanced end thrust is eliminated in this device because, if the thrust is toward the reader's right, the radial seat at *B* will tend to close, while the radial seat at *A* is opened, building up a pressure on the total area of the right side of the impeller. While this is occurring, the radial seat at *C* has closed. and the radial seat at *D* has opened, placing a suction or reduced pressure on the area of the side of the impeller from *C* to the shaft. Hence, the area on the right side of the impeller, subject to high pressure, is greater than the area of the left side of the impeller, subject to same pressure, and also since a suction or lower pressure is exerted against that portion of the left side of the impeller from *C* to the shaft, the pump rotor will tend to move slightly to the left until it reaches a point at which the total pressure will be the same on both sides of the impeller, and true hydraulic balance is obtained.

The opposite cycle of events takes place if the original thrust tends to be toward the reader's left.

Owing to this hydraulic balance, no thrust bearing or collars are required, but since any device will ultimately wear out, small fixed collars are placed on the shaft, set at a distance from the face of the bearing bushing, which will not become operative until the limit of allowable wear has occurred within the case, at which time the engagement of the collars and bearings becomes a visible indication of the need of replacement of wearing parts within the pump. These collars are shown at *E* in each bearing.

Record-size Stationary Diesels Ordered for Panama

The Panama Canal Commission has ordered a Diesel plant that will consist of three Nordberg Diesel engines of 3,750 b.hp. each, the engines being of the two-cycle, single-acting type with six cylinders, 29 in. bore and 44-in. stroke, running at 125 r.p.m. Each engine will be direct-connected to a 3,125 kva. generator of the flywheel type, 3 phase, 25 cycle, 2,200 volt.

Specifications called for the engines to operate for a period of one hour on a 10 per cent overload, which means that they must carry at least 4,125 b.hp. for this period. The engines are very conservatively rated, and for some conditions of service can be used to carry 4,000 hp. without inconvenience.

These engines are the largest stationary Diesels the construction of which has ever been attempted in the United States. This is also the first instance, it is said, where generators of the flywheel type have been used, although this is more or less of a common practice in Europe, where large Diesel engines are used. The total weight of each engine, including generator, is 815,000 lb.

The largest stationary Diesel engines in service today. were also built by this company. They are 2,200 hp. in size and are used by the Phelps Dodge Corporation.

The selection of this type of prime mover by the government indicates the tendency of the day toward adopting the larger Diesel engines where more efficient power is desired, and especially so for standby service in connection with hydro-electric plants.

New Motor for Direct Drive of Slow-speed Compressors

A new type of synchronous motor has recently been developed by the General Electric Co. for direct drive of slow-speed reciprocating compressors which have their greatest application in furnishing compressed air or artificial refrigeration. This motor, bearing the designation TS, is being built in more than 300 standard ratings larger than 20 hp. at sixty-cycle synchronous speeds between 72 and 450 r.p.m. Owing to the nature of compressor drive, these motors are given a maximum rating at a temperature rise of 50 deg. C.

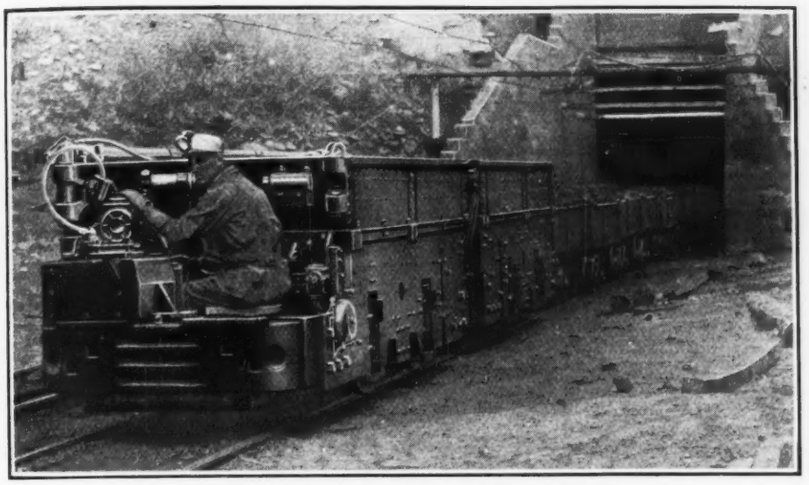
Other synchronous motors have been successfully applied to this slow speed service for a number of years. During that time the definite requirements of compressor drive have been the subject of extensive study and investigation. The results of these tests have now been incorporated in the TS type.

Since the general adoption of electrical equipment in place of slow-speed oil and steam engines for driving compressors, the direct-connected synchronous motor has been popularly accepted for this service in preference to the belted induction motor, because of its great saving in floor space and improvement of power factor. To strengthen and further justify this preference, and to produce the most desirable drive for slow-speed compressors, the TS motor has been carefully designed to obtain (1) extreme simplicity of the starting operation; (2) starting conditions satisfactory to the power company; (3) adequate torques; (4) efficient operation, and (5) minimum flywheel requirements.

Switchboard Instruments Redesigned

The horizontal edgewise switchboard indicating instruments manufactured by the General Electric Co. and known as its H-2 type have been redesigned, and the new line, to be designated as Type H-5, will soon be on the market. The line includes ammeters, voltmeters, wattmeters, power factor meters, and frequency meters, for use wherever the measurement of electrical energy is necessary.

Among the changes made in this line are improved armature coil and pointer construction; increased insulation of current winding; non-corrosive finish on frame, magnets, screws, and other parts; and new strip-wound magnetic shield. The jewels and pivots in these instruments have been reversed, the jewels being mounted on the armature shaft, and the pivots in the frame, thus permitting their ready removal.



A storage-battery locomotive that is charged with a pole from an overhead wire

This locomotive, said to be the largest used in a mine, is in service at the coal property of an important copper mining company at Dawson, N. M. It was described in the issue of Jan. 24, 1925, p. 187. The total weight of the two units in tandem is 38 tons.

Steel Frame Crushers for Coal Preparation

With the increasing use of the single-roll type of crusher for coal preparation has come a corresponding demand for utmost dependability of the crusher unit.

In operation, coal is fed to the crusher in any quantity desired. The rotating toothed roll draws the coal into the tapered opening between the roll and breaker plate, quickly reducing it to the desired size and discharging it below to the belt, elevator, or direct to the bunkers. The cross-section illustration shown indicates clearly the operation of an "Armorframe" single-roll crusher made by the Pennsylvania Crusher Co., Philadelphia, Pa. It also shows the spring relief in case of iron in the feed. The natural agitating action of the teeth passing through the coal on top of the roll produces a shaking action which carries the finer pieces of coal in the feed rapidly through the crushing zone with a minimum of crushing, which partly accounts for the low percentage of fines produced in this type of crusher. The size and adjustment of the spring suspension to prevent the yielding of the springs for any except uncrushable material accounts for the minimum of oversize.

Bethlehem section 30 in. I-beam girders form the side-frame construction of these crushers. Cross members of heavy channel and angle plate are hot-riveted to the girder-beam side frames to form the rigid unbreakable unit construction. Electric steel bearing housings, accurately shouldered into the side frames to take the shear, and hot-riveted in position, are fitted with interchangeable die-cast bearing bushings, and lubrication is provided by steamboat-type grease cups piped to "safety first" locations.

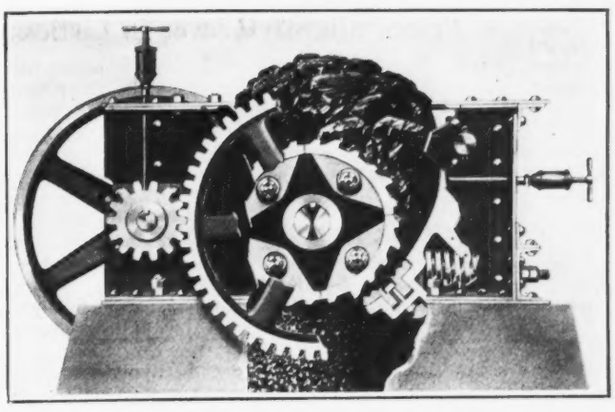
A segmental roll of special patented construction with no bolts through the crushing surface to weaken the segments affords greatest strength and provides ready accessibility for changing when rarely necessary.

The frame carries, in addition to the main roll shaft and the countershaft, a pivoted breaker plate which is readily adjustable to and from the crushing roll to vary the size of product as needed. A 1 in. product with little oversize can be supplied for stoker feed or for pulverizers; 6 in. crushing for preparation of coal for hand-fired locomotive is equally possible. Any size between these two limits is easily obtained by means of the breaker plate adjustment.

Supporting the breaker plate are heavy compression springs, designed to yield for the passage of tramp iron or other uncrushable materials, but which will not permit the passing of oversize coal through the choke feeding of the crusher. The crusher is said to work equally well without feeder and regardless of the amount of coal in hopper or bin over the roll.

Besides the spring suspension of the breaker plate, a special safety device employing an ordinary steel bolt in hardened steel bushings prevents breakdowns in case of large iron in the feed In normal operation this bolt transmits power from the flywheel to the yoke which is keyed to the shaft. This safety device is positive in operation. Both the pinion on the countershaft and the heavy main gear on the crushing roll shaft have cut teeth to insure smooth operation.

Crushing coal with a steel-frame single-roll crusher. The spring shown gives relief in case tramp iron gets into the feed



Trade Catalogs

Diesel Engines—Bulletin 807 of the Fulton Iron Works Co., entitled "The Diesel Engine in Medium Powered Central Stations," discusses the use of Fulton-Diesels in various plants. The equipment required for 1,000 kw. steam plant is contrasted with that required for a 1,040-kw. Diesel plant.

Shovels—"Fifty Years' Experience" is the title of a 16-page booklet recently issued by the Osgood Company of Marion, Ohio. It contains a brief history of the development of excavating machinery made by the company and its predecessors. A copy will be sent on request.

Fire Arches—A handsomely illustrated catalog is the 50-page book just issued by M. H. Detrick Company, 140 South Dearborn St., Chicago, entitled "Detrick Arches." This catalog is profusely illustrated and is intended to show the adaptability of Detrick arches to all types of boilers and stokers, industrial furnaces, and oil stills.

Screening Ball Mill—Bulletin No. 424, issued by the Braun Corporation, 363 New High St., Los Angeles, describes the Herman screening ball mill. Emphasis is paid to the evenness of the product and the absence of oversize in the discharge. No external classification is necessary. The bulletin is profusely illustrated with diagrams showing the construction and features of the mill and the type of product made. Photographs of various installations are included, with details of standard sizes.

Control Systems. — "The Voltage Drop Control System" is the title of a 12-page descriptive bulletin just issued by the General Electric Co. The leaflet is illustrated.

Switches — Safety switch conduits with tumbler switches are described in a folder issued by the Crouse-Hinds Co., of Syracuse, N. Y.

Floodlights—Bulletin No. 2064, recently issued by Crouse-Hinds Co., of Syracuse, N. Y., describes a new floodlight projector having a heat-resisting semaphore lens in the front door and a heat-resisting prismatic glass reflector on the inside of the rear door.

Tanks—The Pacific Tank & Pipe Co. has recently issued catalog No. 16 covering Pacific tanks of all sizes and descriptions. Tank specifications and price list of tanks and tank parts are included. A copy will be sent on request.

The Market Report

Daily Prices of Metals

Mar.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
5	14.35	54.00	54.625	9.00	8.75	7.45
6	14.35	53.25	53.875	9.00	8.75	7.40@7.45
7	14.25@14.375	53.375	54.00	9.00	8.75	7.40@7.45
9	14.25@14.375	52.875	53.625	9.00	8.75	7.40@7.45
10	14.25	52.625	53.375	9.00	8.70	7.30@7.375
11	14.20	52.625	53.25	9.00	8.70	7.30
Av.	14.296	53.125	53.792	9.00	8.733	7.394

*The prices correspond to the following quotations for copper delivered: March 5th and 6th, 14.60c.; 7th and 9th, 14.50c.@14.625c.; 10th, 14.50c.; 11th, 14.45c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Mar.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
5	64¼	65⅜	69½	251½	255	37⅝	36⅜	36⅜	35 11/16
6	64¼	65⅜	69½	248⅞	252	37⅝	36⅜	36 5/16	35 11/16
9	64¼	65¼	69¼	245½	249	37⅝	36 7/16	36 7/16	35 13/16
10	63⅝	64⅝	68¾	242¼	245¾	37⅛	36	35⅞	35 5/16
11	63⅝	64⅝	68½	244⅜	247⅞	36⅞	35¾	35⅛	34¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Mar.	Sterling Exchange "Checks"	Silver		Gold London	Mar.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
5	4.76⅞	68⅛	32 1/16	86s 9d	9	4.76⅜	68⅛	32 3/16	86s 8d
6	4 76⅜	68	32⅛	86s 8d	10	4.76⅜	68⅛	32 1/16	86s 9d
7	4.76⅛	68⅛	32 3/16	.. ...	11	4.76⅝	68⅛	32⅛	86s 8d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Prices Slightly Lower in Listless Market

New York, March 11, 1925—Consumers of metals again have taken little interest in the market during the week ending today, and prices have slumped a little more as a consequence, though no important declines have taken place.

Copper Back to 14½c.

Sales of copper were made in fair volume last Thursday and Friday, the price obtained by most producers being 14⅝c. for April and May shipment, though some odd lots were picked up slightly below this level. Saturday and Monday the market was very uneven, with practically no business done by any one; producers were not willing to go below 14⅝c. and consumers refused to bid more than 14½c. What little business there was was booked, in most cases, between these levels. On Tuesday producers came down to 14½c., selling a little, and today quoted the same without attracting orders, though one seller booked an attractive lot at 14.45c.

The foreign market has also been quiet, with only occasional sales in England and on the Continent. Until today, the principal American agencies were asking 14.95c., c.if., the same as last week, but today at least one important agency came down to 14.625c., which is about the level at which small outside sales had been taking place in the last two days.

Lead Market a Little Easier in the West

The official contract price of the American Smelting & Refining Co. continues at 9c. per lb. New York.

Although rumors have been current during the week that lead could be obtained and was sold below 9c. in New York, no sales have been reported under that price Nine cents was the level at which all the lead business seems to have been transacted. No disposition was noticeable on the part of any producer to shade this quotation. Sales in the New York district outside of fixed price transactions on contracts were unusually light, with the market a little more active in the last few days than in the latter part of last week. In St. Louis, sales in the open market were made up to Tuesday without difficulty at 8.75c per lb. for both March and April shipment. On Tuesday, however, this price was cut five points to 8.70c., at which price a fair tonnage was bought. Just now the market appears to be finding a price that can be maintained longer than any so far on the decline. The weakness of the London market, which has dropped slowly but steadily throughout the week, has had a tendency to sober the market in the United States.

Zinc Near the Bottom

Zinc sales have been better than last week, but the volume of business has not been sufficient to prevent prices declining to about 7.30c. At present levels, traders have shown an inclination to buy up the free supplies, and at 7¼c. galvanizers have indicated that they would buy a comparatively large tonnage, so that today's price may be near the bottom for the current movement unless further weakness develops in London. Prompt zinc continues about 5 points above that for April, as most of the galvanizers that have bought have asked for immediate shipment, indicating the fundamental strength of the market. Producers are patiently awaiting the foreign demand, which they feel cannot be postponed much longer.

Statistics for February prepared by the American Zinc Institute follow:

Stock, Feb. 1, tons	18,996
Produced, tons	46,811
Shipped, tons	49,104
Stock, Feb. 28, tons	16,703
Shipped from plant for export, tons	6,467
Stored for customers, tons	90
Retorts operating, Feb. 28	87,377

The figures are considered very favorable, indicating, as they do, continued large domestic consumption.

High-grade continues in fair demand at 8¾c. delivered.

Price of Tin Declines

Owing to activity in the tin market last week, which enabled many consumers to satisfy their requirements for the time being, the tin market has been dull. Although prices have been cut, they have not been sufficiently attractive to place much business. The market was a bit stronger on Wednesday, with Straits tin quoted at 53¼c. per lb.

Silver Steady

Fluctuations in quotations for silver during the past week have been within narrow limits. The market remains steady with reported buying for India account.

Mexican Dollars: March 5th, 52½c.; 6th, 52⅝c.; 7th, 9th, 10th, and 11th, 52½c.

Foreign Exchanges Quiet

Foreign exchanges show no important changes from last week. On Tuesday, March 10, closing cable quotations on francs were 5.1525c.; lire, 4.0975c.; and marks, 23.81c. Canadian dollars, ⅛ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125.

Antimony—
Chinese brands, 16.50@17c. per lb.
Cookson's "C" grade, 18⅜c.
Chinese needle, lump, nominal, 10c.

Standard powdered needle, 200 mesh, 11½@13c.

White oxide, Chinese, 99 per cent Sb_2O_3, 16@16½c.

Bismuth—$1.95 per lb., in ton lots. London, 7s. 6d.

Cadmium—60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—$325 per oz.

Nickel—Ingot, 31c.; shot, 32c.; electrolytic, 38c.; London, £170 per long ton.

Palladium—$79@$83 per oz. Crude, $60@$65.

Platinum—$117 per oz. for refined. Crude, $115.

Quicksilver — $80 per 75-lb. flask. London, £12⅜.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the prices given in the March 7 issue.

Metallic Ores

Chrome Ore—Indian ore, $21@$22 per ton, c.i.f. Atlantic ports.

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, $10@$10.50.
High-grade Western scheelite, $10.50 @$11.

Iron Ore, Galena Radio Crystals, Manganese, Molybdenum, Tantalum, and Vanadium Ores are unchanged from March 7 quotations.

Zinc Blende Slightly Stronger—Lead Ore Unchanged

Joplin, Mo., March 7, 1925

Zinc Blende	Per Ton
High	$56.30
Premium, basis 60 per cent zinc	$55.00@$56.00
Prime Western, 60 per cent zinc	$53.00@$54.00
Fines and slimes, 60 per cent zinc	$52.00@$50.00
Average settling price, all	$51.91

Lead Ore	
High	$127.70
Basis 80 per cent lead	$115.00
Average settling price, all	$124.41

Shipments for the week: Blende, 19,975; calamine, 106; lead, 2,848 tons. Value, all ores the week, $1,394,980.

There was loaded and billed for export 495 tons of the 1,000 tons arranged for last week. This shipment is a follow-up of a small tonnage previously exported as a test.

A half-dollar advance in zinc prices was general on premium grades, and was made in several instances for Prime Western grades. No further lowering of lead prices occurred.

Stocks are still receding, on account of heavy shipments, and estimating that approximately 25,000 tons are now regularly purchased ahead of shipment, and that 5,000 to 6,000 tons are sold ahead of production, it is readily apparent that there is no salable ore except that produced each week, as the total stocks in bins will not exceed 32,000 tons.

Platteville, Wis., March 7, 1925

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$56

Lead Ore	
Lead, basis 80 per cent lead	$115

Shipments for the week: Blende, 775; lead, 40 tons. Shipments for the year: Blende, 6,904; lead, 406 tons. Shipments for the week to separating plants, 1,526 tons blende.

Non-Metallic Minerals

Diatomaceous Earth—$65, pulverized grade, $75, air float, per ton, f.o.b. mill.

Other quotations in March 7 issue.

Mica—White, dry ground, f.o.b. mill:
20 mesh, $30 per ton.
40 mesh, $50.
60 mesh, $65.
100 mesh, $80.
200 mesh, $90.
Other mica prices in March 7 issue.

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from March 7 prices.

Mineral Products

Arsenious Oxide (white arsenic)—5½@5⅝c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and Zinc Oxide are unchanged from March 7 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, $115 per gross ton, f.o.b. works, or duty paid at seaport.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the March 7 issue.

Metal Products

Rolled Copper — Sheets, 22½c.; wire, 16⅜c.

Lead Sheets—11½c. per lb.

Yellow Metal, Nickel Silver and **Zinc Sheets** are unchanged from March 7 prices.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and Zirkite are unchanged from March 7 prices.

Steel and Pig Iron Quiet

Pittsburgh, March 10, 1925

Steel production has held up better to date than seemed likely a few weeks ago. Heavier operations in the South and West have balanced slight decreases in the Pittsburgh and Youngstown districts, and steel ingot production from Jan. 1 to date has averaged about 90 per cent of capacity, against an average of 74 per cent in the last two years. Some decrease, however, is inevitable, as production has exceeded consumption while jobbers and manufacturing consumers were replenishing stocks. Consumption has been increasing, partly under the influence of the season.

The various price advances made in late January and early February, in bars, shapes, plates, sheets, and wire products, have practically failed with respect to erecting any volume of buying, but as there has been some advances in November and December, prices in current transactions average above the level of current deliveries on old orders and contracts. Continued buying of fair volume is expected, with mill operations gently sagging off to about a 75 per cent rate.

Pig Iron—Foundry iron, quotable lately at $22, Valley, was selling only in a limited way and in small prompt lots. The Standard Sanitary Manufacturing Co., in buying 20,000 tons for second quarter, developed a $21 price, at which there may now be buying by other large consumers. Basic sold recently at $21.50, but is not fairly quotable at above foundry. Bessemer remains at $22.50, Valley.

Connellsville Coke—Some contracts for second-quarter furnace coke have been practically concluded, involving an understanding that wages are to be reduced to the level obtaining before the December advance, and furnace coke will probably cost about $3.50. Spot is weak at $3.75, with smelter and heating at $3.50 or less, and spot foundry at $4.25@$4.75.

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$10.00[1]
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	15.90	.....
Houghton, Mich.	New York	(a) 11.40	.....
Hancock, Mich.	New York	(a) 11.40	.....
Hubbell, Mich.	New York	(a) 11.40	.....
Dollar Bay, Mich.	New York	(a) 11.40	.....
Tacoma, Wash.	New York via Canal	Conference rate	$6.00
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

[1] Via Trans-Marine Corporation $9.40.

(a) Applies Dec. 1 to Mar. 31.

Marine Freight Rates

New York to
- Hamburg: *$4.50 per gross ton copper and lead
- Liverpool: 5.50 per gross ton copper and lead
- Antwerp: *4.00 per gross ton copper and lead
- Havre: 4.75 per gross ton lead; 5.00 per gross ton copper

Gulf ports to
- Hamburg: *$4.50 per gross ton copper and lead
- Liverpool: 5.50 per gross ton copper and lead
- Antwerp: *4.00 per gross ton copper and lead
- Havre: 5.00 per gross ton copper

Pacific coast ports to
- Hongkong: $6.00 per short ton copper and lead
- Kobe: 6.00 per short ton copper and lead

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	*12.50	$9.00
Leadville, Colo.	12.50	*9.00
East Helena, Mont	12.50	9.50
El Paso, Tex.	10.00 Via Gulf	
	12.00 All Rail	7.00
Omaha, Neb.	9.60	3.65
Murray, Utah	12.50	9.00
Midvale, Utah	12.50	9.00
Tooele, Utah	12.50	9.00
East Chicago, Ill.	6.40	(a) 1.60
Kellogg, Idaho	13.50	9.50
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(b) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E. St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50
Amarillo, Tex	5.80	12.80

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.40
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
Kusa, Okla.	Cent City Spur, Mo.	2.00
Henryetta, Okla.	Chitwood, Mo.	2.00
	Galena, Kan.	1.50
	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	1.01
Great Falls, Mont.	East Helena, Mont.	....	....	1.57	....	1.76	....	1.98	....	2.43	....	....	....	....	....	2.55
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	6.30	7.00	7.70	....	8.35	8.60	8.85
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	4.50(c)	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	....	5.90	....	6.30	....	....	....	7.70
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.50	6.00	6.30	....	6.60	7.10	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	2.30	2.55	....	2.80	....	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	....	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C. (d)	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.11	2.56	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing.
(d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	.....	....	....	1.02
Burke and Wallace, Idaho (d)	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	.....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	....	....	.....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	.....	5.12½
Park City, Utah	Salt Lake Smelters	1.00(e)	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain, Nev. (a)	Salt Lake Smelters	....	4.15	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	....	2.90	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.50
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.80
Shirley, Colo.	Leadville, Colo.	....	....	2.25	....	2.25	....	2.25	2.25	4.30	4.30	.....	4.30	4.30	4.30

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton, effective July 7.
(e) For $9 value rate is 95c.; $8 value, 90c.; $7 value, 85c.; $6 value, 80c.
*Indicates a change of tariff since last report.

Company Reports

American Smelting & Refining Co.

The year 1924 showed an improvement in the A. S. & R. Co.'s business. Net income available for dividends, after deducting all charges, taxes, bond interest, depreciation, and depletion, was $11,186,990.71, compared with $8,924,581.56 in 1923. Earnings per share of common stock, after paying dividends on preferred, were $12.60, compared with $8.89 in 1923.

The company is in a strong cash position, having on hand on Dec. 31, 1924, in cash, call loans, government securities, and bankers' acceptances, $26,314,989.87, an increase of $5,477,237.17 over Dec. 31, 1923. There are no outstanding bank loans or other loans.

In view of the increased earnings and of the favorable prospects for the future, the directors felt justified, at the end of the year, in increasing the dividend payable on the common stock on Feb. 1, 1925, to the rate of 6 per cent per annum.

The company has, during 1923 and 1924, appropriated and expended for mines, new undertakings, and improvements, amounts as follows:

	Appropriations			Expenditure
Year	Plants Other Than Mining	Acquisition and Development of Metal and Coal Mines	Total	
1923	$5,474,873	$5,004,466	$10,479,339	$5,271,604
1924	4,061,978	6,843,730	10,905,708	10,415,472
Total	$9,536,851	$11,848,196	$21,385,047	$15,687,076

Summary of Consolidated Income and Profit-and-Loss Surplus Account

	Year Ended Dec. 31, 1924	Year Ended Dec. 31, 1923
Net earnings of smelting and refining plants	$18,390,080.90	$16,091,420.46
Net earnings of mining properties	3,081,425.18	3,465,579.83
Other income—net	1,469,422.90	597,914.48
Net earnings, before deducting general and administrative expenses and corporate taxes	$22,940,928.98	$20,154,914.77
Deduct general expenses	3,109,203.26	2,838,326.14
Net income from current operations	$19,831,725.72	$17,316,588.63
Deduct		
Interest on first-mortgage bonds		
Series "A" 5 per cent	$2,043,023.36	$2,101,499.83
Series "B" 6 per cent	575,827.23	375,945.12
Depreciation and obsolescence	3,905,617.08	4,014,595.83
Ore depletion	2,120,267.34	1,899,966.29
Total	$8,644,735.01	$8,392,007.07
Net income	$11,186,990.71	$8,924,581.56
Deduct		
Dividends on		
A. S. & R. Co. preferred stock	$3,500,000.00	$3,500,000.00
A. S& R. Co. common stock	3,202,395.00	2,287,425.00
A. S. S Co. preferred "A" stock	.....	30,029.00
A. S. S.Co. preferred "B" stock	.....	2,352.01
Net deduction	$6,702,395.00	$5,819,806.01
Surplus income	4,484,595.71	3,104,775.55
Balance at beginning of year	17,767,785.67	15,438,543.07
Total	$22,252,381.38	$18,543,318.62
Deduct appropriations and profit-and-loss adjustments:	5,466,848.49	775,532.95
Balance at end of year	$16,785,532.89	$17,767,785.67

Consolidated General Balance Sheet, December 31, 1924

Assets

Capital assets:		
Property		$119,699,313.12
Investments—Securities of and advances to affiliated companies		5,208,035.42
Total capital assets		$124,907,348.54
Current and Miscellaneous Assets		
Total cash, government and other securities	$26,314,989.87	
Accounts receivable	11,561,939.74	
Notes receivable, due in 1925	45,934.66	
Materials and supplies	7,072,568.50	
Metal stocks	38,330,949.85	
Miscellaneous	2,928,748.24	
Cash and securities in funds	2,301,085.76	
Total current and miscellaneous assets		88,556,216.62
Total assets		$213,463,565.16

Liabilities

Bonds outstanding		
A. S. & R. Co. Series "A" 5 per cent first mortgage		$40,529,100.00
A. S. & R. Co. Series "B" 6 per cent first mortgage		9,571,000.00
Total		$50,100,100.00
Preferred capital stock—authorized and outstanding		50,000,000.00
Common capital stock—issued and outstanding		60,998,000.00
Total funded debt and capital stock		$161,098,100.00
Current and miscellaneous liabilities		19,546,924.66
Reserves and Profit-and-loss Surplus		
Reserves	$16,033,007.61	
Profit-and-loss surplus	16,785,532.89	
Total reserves and profit-and-loss surplus		32,818,540.50
Total liabilities		$213,463,565.16

Metal Production

	Year 1924
Ounces gold produced	1,868,407
Ounces silver produced	92,229,349
Ounces platinum and palladium produced	1,998
Tons lead produced	412,416
Tons copper produced	522,472
Tons spelter produced	39,450
Tons tin produced	486
Tons arsenic produced	10,473
Tons sulphuric acid produced	35,259
Pounds by-product metals produced	20,146,769

Saint Mary's Mineral Land Co.

Sales of Saint Mary's Mineral Land Co. during 1924 were as follows:

3,880 acres of wood and timber	$172,930.00
310.37 acres of surface only	7,450.32

The real property of the company Dec. 31, 1924, consisted of 91,734.69 acres, besides the mineral rights to 15,410.96 additional acres.

The cash receipts and expenditures for 1924 were as follows:

Receipts

Cash on hand Dec. 31, 1923	$84,247.66
Sundry other receipts	729,131.92
	$813,379.58

Expenditures

Advances, salaries, taxes, etc	$678,954.67
Cash on hand Dec. 31, 1924	$134,424.91

During the year no purchaser has been found for any part of the company's extensive holdings of mineral lands.

Stockholders received a payment of $3 per share on May 20.

The Mass Consolidated Mining Co.

Copper; Michigan

The treasurers report of the Mass Consolidated Mining Co. for 1924 follows:

Receipts

Balance current assets, Dec. 31, 1923		$7,147.38
Equipment sales	$693.20	
Real estate and timber sales	21,965.00	
Rents	2,643.75	
		25,301.95
		$32,449.33
Expenses		
Taxes and insurance	10,135.47	
General expense	8,225.56	
Inventory loss	6,672.56	
		25,033.59
Balance current assets, Dec. 31, 1924		$7,415.74

Financial Notes of the Mining Companies

British America Nickel—Properties will be sold at auction in Toronto on March 20. There are outstanding $7,712,500 Class A income bonds, and $14,399,099 Class B income bonds.

St. Joseph Lead—At annual meeting J. Herndon Smith, of St. Louis, was elected a director in place of L. H. Besson, resigned. Other officers and directors were re-elected.

Mining Stocks

Week Ended March 7, 1925

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*6	...	...
Anaconda	New York	43⅛	42	42	Ja.17, Fe.16,	0.75
Arcadian Consol.	Boston	2	1 13/16	1 7/8	...	...
Ariz. Com'l.	Boston	13⅛	12⅛	13	Ja. 19, Ja. 31	0.50
Calaveras	N. Y. Curb	1⅛	1⅛	1⅛	...	...
Calumet & Arizona	New York	54½	52	52	Mh.6, Mh.28 Q	0.50
Calumet & Hecla	Boston	50⅛	50⅛	50⅛	Ja.30, Mh.4	0.50
Canario Copper	N. Y. Curb	4	3⅞	4	...	...
Cerro de Pasco	New York	52⅛	51	51⅛	Ja. 22, Fe. 2, Q	1.00
Chile Copper	New York	36	34⅛	35	Mh.3,Mh.20, Q	0.62½
Chino	New York	25⅛	24⅛	24⅛	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3 3/16	3 1/16	3⅛	...	...
Copper Range	Boston	28	27	27	May, 1924	1.00
Crystal Copper	Boston Curb	*62	*56	*60	...	...
Davis-Daly	Boston	...	...	*78	Mar., 1920	0.25
East Butte	Boston	5	5	5	Dec., 1919	0.50
First National	Boston Curb	*28	*26	*26	Feb., 1919	0.15
Franklin	Boston	1⅛	1	1	...	...
Gadaden Copper	Boston Curb	*65	*65	*65	...	...
Granby Consol.	New York	19⅜	18⅜	18⅜	May, 1919	1.25
Greene-Cananea	New York	16⅛	15⅞	16⅛	Nov., 1920	0.50
Hancock	Boston	1⅛	1⅛	1⅛	...	...
Howe Sound,new,r.t.e	N. Y. Curb	21⅛	20⅜	21⅛	April 1924	0.05
Inspiration Consl.	New York	28⅛	27	27	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	2⅛	2⅛	2⅛	May, 1923	0.15
Isle Royale	Boston	17	16⅛	17	Sept. 1923	0.50
Jerome Verde Dev.	N. Y. Curb	1 3/16	1	1⅛	...	...
Kennecott	New York	54⅜	52⅛	52⅞	Mh.6, Ap.1, Q	0.75
Keweenaw	Boston	*90	*75	*75	...	...
Lake Copper	Boston	2⅛	1⅞	2⅛	...	...
Magma Copper	New York	41	39⅜	40⅛	Jan., 1919	0.50
Mason Valley	N. Y. Curb	2	1⅞	1⅞	...	...
Mass Consolidated	Boston	*75	*75	*75	Nov., 1917	1.00
Miami Copper	New York	21⅛	14⅛	14⅛	Fe.2 Fe.16 Q	0.50
Mohawk	Boston	35⅛	35	35	Ja. 13, Mh. 2	1.00
Mother Lode Coa.	New York	8	7⅞	7⅞	De. 12, De. 31	0.37½
Nevada Consol.	New York	15	14⅛	14⅜	Sept., 1920	0.25
New Cornelia	Boston	22⅛	22	22⅛	Fe. 6, Fe. 23	0.25
New Dominion	Boston	...	...	*70	...	...
North Butte	Boston	2⅛	1⅞	2	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	1 1/16	1	1	No.14, De.2	0.05
Old Dominion	Boston	23⅜	22	22⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†122	†118	...	De.2, Ja.2 Q	1.00
Quincy	Boston	31	30	30	Mar., 1920	1.00
Ray Consolidated	New York	15⅛	14⅞	14⅞	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	...	...	*8	...	...
St. Mary's Min. Ld.	Boston	42	39	40	May 1924	3.00
Seneca Copper	New York	...	...	...	...	...
Shannon	Boston	*97	*95	*95	Nov., 1917	0.25
Shattuck Arizona	New York	6⅞	6⅞	6⅞	Jan., 1920	0.25
Superior & Boston	Boston	1⅛	1⅛	1⅛	...	...
Tenn. C. & C.	New York	8⅜	8⅛	8⅜	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	26⅛	25⅜	26	Ja. 2, Fe. 2	0.50
Utah Copper	New York	88⅛	86⅛	87⅜	De.12, De.31,Q	1.00
Utah Metal & T.	Boston	*68	*70	*70	Dec., 1917	0.30
Victoria	Boston	...	...	*60	...	...
Walker Mining	N. Y. Curb	3	3	3	...	...
Winona	Boston	*20	*14	*16	...	...
NICKEL-COPPER						
Internat. Nickel	New York	27⅛	26⅛	26⅛	March, 1919	0.50
Internat. Nickel pfd.	New York	97⅛	97¼	97¼	Ja. 15, Fe. 2, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	8⅛	7⅛	8	...	...
National Lead	New York	162⅛	157	160⅛	Mh.13,Mh.31,Q	2.00
National Lead pfd.	New York	118	118	118	Fe.2, Mh.14, Q	1.75
St. Joseph Lead	New York	44⅛	42¼	43⅜	Mh. 5, Mh. 20	0.50
ZINC						
Am. Z. L. & S.	New York	9⅛	9⅛	9⅛	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	31⅛	31	31⅛	Nov., 1920	1.50
Butte C. & Z.	New York	7⅛	7⅛	7⅛	De.10, De.24	0.50
Butte & Superior	New York	19⅜	18⅛	19⅛	June, 1923	0.50
Callahan Zn-Ld.	New York	4	3⅞	3⅞	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	192	190	191⅛	Ja.20, Fe.10	2.00
United Zinc	N. Y. Curb	*40	*40	*40	...	...
Yellow Pine	Los Angeles	...	...	*72	De.10,De.15 Q	0.04
SILVER						
Alvarado	Boston Curb	2	1¼	2	Oct. 1920	0.50
Beaver Consol.	Toronto	*35⅛	*33⅛	*33⅛	May, 1920	0.03
Castle-Trethewey	Toronto	*84	*77⅛	*83	...	...
Coniagas	Toronto	2.02	1.99	2.00	May, 1924	0.12½
Keeley	Toronto	2.10	1.99	2.04	Mh.1,Mh.15 SA	0.12
Kerr Lake	N. Y. Curb	1⅜	1⅜	1⅜	Ap.1, A p15,	0.12½
La Rose	Toronto	*43	*41⅞	*43	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.20	1.16	1.17	...	...
McKinley-Dar.-Sav.	Toronto	*40⅛	*32⅛	*41	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.86	2.68	2.70	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅛	6	6⅛	Ja.18,Ja.20,QX	0.30
Ontario Silver	New York	...	...	7	Jan., 1919	0.50
Temiskaming	Toronto	*30⅛	*28	*29	Jan., 1920	0.40
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛	...	...
Argonaut	Toronto	*40⅛	*38	*38	...	...
Carson Hill	Boston	*45	*40	*40	...	...
Consol. W. Dome L.	Toronto	*17⅜	*16⅛	*17⅛	...	...
Cresson Consol. G.	N. Y. Curb	3⅜	3⅜	3⅜	De.31, Ja.10 Q	0.10
Crown Reserve	Toronto	*45	*42⅛	*44	Jan. 1917	0.05
Dome Mines	New York	16	15⅜	15⅛	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	...	...	1.51	Dec.11, 1924	0.03
Hollinger Consol.	Toronto	14.55	14.40	14.50	Mh.20,Mh.25M	0.05
Homestake Mining	New York	45	44	45	Mh.20,Mh.25,M	0.50
Jib. Cons'l.	N.Y. Curb	*33	*18	*26	...	...
Kirkland Lake	Toronto	*47	*44½	*45½	...	...
Lake Shore	Toronto	5.80	5.50	5.70	Mh.2,Mh.16,	0.05
McIntyre-Porcupine	New York	18	17⅞	17⅞	Fe.2, Mh.2,	0.25
Newray	Toronto	*25¼	*25	*25	...	...
Night Hawk Pen.	Toronto	*26	*25	*25½	...	...
Portland	Colo. Springs	...	...	*45	Oct., 1920	0.01
Rand Mines	New York	...	...	35½	Fe.17, Fe.25	1.79
Teck-Hughes	Toronto	1.47	1.39	1.46	...	...
Tom Reed	Los Angeles	...	...	*62	Dec., 1919	0.02
Tough-Oakes	Toronto	*37	*35½	*36½	...	...
United Eastern	N. Y. Curb	*51	*50	*51	July, 1924	0.05
Vipond Cons.	Toronto	1.26	1.19	1.23	...	...
Wright-Hargreaves	Toronto	4.75	4.65	4.65	Mh.16,Ap.1,QX	0.05
GOLD AND SILVER						
Black Oak	N. Y. Curb	...	...	*81	...	...
Con. Cortez	N. Y. Curb	...	...	*20	...	...
Con. Virginia	San Francisco	...	...	*5⅛	...	...
Continental Mines	N. Y. Curb	...	...	1½	...	...
Dolores Esperanza	N. Y. Curb	*75	*60	*75	July. 1923	0.05
Premier Gold	N. Y. Curb	2 1/16	2 1/16	2⅛	De.22, Ja.5,QX	0.10
Tonopah Belmont	N. Y. Curb	*85	*75	*75	Mh.15, Ap.1	0.05
Tonopah Divide	N. Y. Curb	*25	*25	*25	Se. 22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	3	2⅞	2⅞	Mh.11, Ap.1, Q	0.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Fe. 12,Fe. 25,	0.50
Unity Gold	N. Y. Curb	*58	*58	*58	...	...
West End Consol.	N. Y. Curb	*30	*30	*30	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*35	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	12⅛	10⅜	12⅜	Mh.16, Ap.2,X	0.25
Bingham Mines	Boston	34⅛	32⅛	32⅛	Mh.20, Mh.31	0.50
Cardiff M. & M.	Salt Lake	1.30	1.30	1.30	De.16, No.18	0.10
Chief Consol.	Salt Lake	3.75	3.70	3.75	May, 1924	0.10
Columbus Rexall	Salt Lake	*24	*24	*24	Aug., 1923	0.05
Erupcion	Boston Curb	3⅛	3⅛	3⅛	Mh.16, Ap.2,X	0.20
Federal M. & S.	New York	20⅛	20	20	Fe.26, Mh.15 Q	1.75
Federal M. & S. pfd.	New York	58⅛	56	56	No.25, De.15,	1.75
Florence Silver	Spokane	*4⅛	*4⅛	*4⅛	Apr., 1919, QX	0.0
Hecla Mining	N. Y. Curb	16	14⅛	15⅛	Fe.15, Mh.15	0.5
Iron Blossom Con.	Salt Lake	*31	*29	*29	Oc.25, 1924	0.01½
Iron King Mining	Salt Lake	*78	*70	*73	...	...
Keystone Mining	Salt Lake	*77	*76	*76	...	...
Mammoth Mining	Salt Lake	1.02½	1.00	1.00	...	...
Marsh Mines	N. Y. Curb	*6	*5	*5	June, 1921	0.02½
Park City	Salt Lake	...	...	5.50	De. 15, Ja. 2	0.15
Park Utah	Salt Lake	3.92½	3.75	3.75	April, 1924	0.15
Prince Consol.	Salt Lake	*26	*21	*26	...	...
Silver King Coal	Salt Lake	6.65	6.00	6.65	De.20, Ja 2, Q	0.20
Silversmith	Spokane	*28½	*28	*28	Ja. 1, Ja. 10	0.02
Tamarack-Custer	Spokane	*73	*69	*70	Se. 22, Se. 29	0.25
Tintic Standard	Salt Lake	9.00	8.75	9.00	Ja.2, QX	0.50
Utah-Apex	Bostor	6⅞	6⅛	6⅛	Ja.10, Ja.15,	0.25
IRON						
Bethlehem Steel	New York	47⅛	45	45	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	...	...	*20	...	...
Char. Iron pfd.	Detroit	...	...	*85	...	...
Colorado Fuel & Iron	New York	46⅛	43⅜	44	May, 1921	0.75
Gt. North'n Iron Ore	New York	38⅜	37⅛	37⅛	De.10, De.27	2.00
Inland Steel	New York	46⅛	45⅜	46	Fe.14, Mh.20 Q	0.625
Mesabi Iron	N. Y. Curb	3⅞	3⅛	3⅜	...	...
Replogle Steel	New York	19⅛	17⅜	18⅛	...	...
Republic I. & S.	New York	55	52⅛	53⅛	May, 1921	1.50
Republic I. & S. pfd.	New York	92	90⅛	90⅜	Mh.8, Ap.1, Q	1.75
Sloss-Sheffield S. & I.	New York	94	89⅜	91	Mh.10, Mh.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	97	Mh.20, Ap.2, Q	1.75
U. S. Steel	New York	125⅛	122⅛	124	Fe.28,Mh.30,QX	1.75
U. S. Steel pfd.	New York	124	123	123⅛	Fe.1, Fe.27, Q	1.75
Virginia I. C. & C.	New York	...	...	40	De.15, Ja.2	1.50
Virginia I.C.&C.pfd.	New York	75	75	75	De. 13, Ja. 2, Q	2.50
VANADIUM						
Vanadium Corp.	New York	30⅛	28⅛	29	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*20	*20	*20	...	...
ASBESTOS						
Asbestos Corp.	Montreal	44	43⅛	44	Fe.1, Fe.15 Q	2.00
Asbestos Corp. pfd.	Montreal	85	84	84	Ja.2, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	10⅛	8⅛	8⅛	Nov., 1919	1.00
Texas Gulf	New York	112⅛	107	110⅛	Mh.2, Mh.14,	1.75
DIAMONDS						
De Beers Consol.	New York	22⅛	22⅛	22⅛	Ja.6, Fe.2	0.95
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3	3	3	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	50⅜	49⅛	50	Fe.18, Mh.2 Q	0.75
Amer. Metal pfd.	New York	114⅜	114⅛	114⅜	Fe.19, Mh.2, Q	1.75
Amer. Sm. & Ref.	New York	103⅜	98⅛	99⅛	Ja.16, Fe.2, Q	1.50
Amer.Sm.&Ref.pfd.	New York	109	108⅜	108⅞	Fe.6, Mh.2 Q	1.75
Consol. M. & S.	Montreal	72⅛	68⅛	69⅛	De.11, Ja.15 SA	0.75
Federated Metals	N Y. Curb	...	...	37⅛	...	...
Southwest Metals	N. Y. Curb	*75	*75	*75	...	...
U. S. Sm. R. & M.	New York	35	32⅛	34	Jan., 1921	0.50
U.S. Sm. R.&M.pfd.	New York	45⅛	45	45	Ja.8, Ja.15	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange and George H. Watson & Co.; Colorado Springs, Colorado Springs Stock Exchange.